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# Flexible, Efficient, and Stable Adversarial Attacks on Machine Unlearning

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# Abstract

Machine unlearning (MU) aims to remove the in-011 fluence of specific data points from trained models, enhancing compliance with privacy regulations. However, the vulnerability of basic MU models to malicious unlearning requests in ad-015 versarial learning environments has been largely overlooked. Existing adversarial MU attacks suffer from three key limitations: inflexibility 018 due to pre-defined attack targets, inefficiency in handling multiple attack requests, and instabil-020 ity caused by non-convex loss functions. To address these challenges, we propose a Flexible, Efficient, and Stable Attack (DDPA). First, leveraging Carathéodory's theorem, we introduce a convex polyhedral approximation to identify points 025 in the loss landscape where convexity approximately holds, ensuring stable attack performance. Second, inspired by simplex theory and John's 028 theorem, we develop a regular simplex detection 029 technique that maximizes coverage over the pa-030 rameter space, improving attack flexibility and efficiency. We theoretically derive the proportion of the effective parameter space occupied by the constructed simplex. We evaluate the attack suc-034 cess rate of our DDPA method on real datasets 035 against state-of-the-art machine unlearning attack methods.

# 1. Introduction

Machine unlearning (MU) aims to give data holders the right to remove the influence of a certain subset of data from a trained machine learning (ML) model, while maintaining the accuracy of the ML model on remaining data (Garg et al., 2020a; Gupta et al., 2021; Nguyen et al., 2022; Wu et al., 2022). Although MU research have attracted significant attention for their ability to protect the right to be forgotten, most of existing studies focus on the improvement of effectiveness and efficiency of MU algorithms (Chowdhury et al., 2024; Aldaghri et al., 2020; Yan et al., 2022; Kumar et al., 2022; Dukler et al., 2023; Golatkar et al., 2023; Pratama & Gambetta, 2024; Yang et al., 2024).

Despite achieving remarkable performance, recent studies have shown that basic MU models are vulnerable to malicious unlearning (i.e., data removal) requests during the unlearning process in adversarial settings (Liu et al., 2024; Di et al., 2024; ZHAO et al., 2023; Zhang et al., 2023; Huang et al., 2024b; Ma et al., 2024; Shin & Park, 2024; Zhao et al., 2024; Hu et al., 2024). An attacker can inject some carefully-designed data samples to the training dataset such that the MU model behaves benign without impact on the model prediction. Afterwards, the attacker submits a unlearning request to remove the perturbed data samples, so as to negatively affect the prediction of MU models (Liu et al., 2024; Di et al., 2024; ZHAO et al., 2023; Shin & Park, 2024).

Current mainstream research in adversarial attacks on MU concentrates on target attacks to degrade the performance of MU models, including misclassifying specific data samples (Liu et al., 2024; Di et al., 2024; Zhang et al., 2023; Huang et al., 2024b; Ma et al., 2024; Shin & Park, 2024) and misclassifying data samples into a specific class (ZHAO et al., 2023; Hu et al., 2024). Nevertheless, three critical challenges remain open: (1) Flexibility. These approaches require to know which attack targets before the data poisoning process. That is, these attacks are attack target-specific: the malicious unlearning requests regarding the perturbed data samples that are related to specific attack targets are only effective for specific data samples or specific class. This flexibility concern dramatically limits the applicability of such attacks in real scenarios; (2) Efficiency. In practice, a large ML model like Stable Diffusion (Rombach et al., 2022) often faces the arrival of a series of MU requests with different attack targets. In this case, the attacker need to sequentially redo the data poisoning operations and the attack processes one by one to adapt to diverse attack targets, resulting in non-trivial computational costs; and (3) Stability. The non-convexity of loss functions in ML and MU models poses significant challenges for existing MU attack methods, as they are vulnerable to the pitfalls of local minima of model parameters. These local minima can sig-

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*Figure 1.* Attack workflow of our FESA attack.

nificantly degrade the performance of MU models and thus cause large deviations from the intended attack outcomes, leading to MU attack failure.

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To our best knowledge, this work is the first to conduct the problem of adversarial attacks on machine unlearning, while holding the attack target-agnostic property, supports on-demand attacks to attack arbitrary targets upon attackers' demands and quickly responding to a series of MU attack requests after the MU models are deployed, and maintaining the stability of MU attacks, by leveraging the theory of thrust vector control, Simplex Geometry, and convex polyhedron.

Thrust vector control is a technique widely used in aerospace
engineering that an aircraft or rocket manipulates the direction of the thrust from its engines to control the attitude or
angular velocity of the vehicle (Praveen et al., 2023). This
motivates us to establish a connection between thrust vector
control for moving the aircraft and rocket towards arbitrary
locations and thrust vector control for moving the parameter
of attacked MU models towards parameters corresponding
to any attack targets upon attackers' demands.

089 First, following (Zhang et al., 2023), given some clean in-090 stance, we randomly select multiple data samples from the 091 clean instance as the initial group centers V. In order to 092 tackle the instability issue of MU attacks due to the non-093 convexity of loss functions, we propose a convex polyhedral 094 approximation method to transform the original non-convex 095 loss function into a convex version. Notice that directly 096 enforcing the convexity on the original loss function is im-097 practical because the model owner has no justification for 098 accommodating user requests to modify the model parame-099 ters and loss functions. Next, we model the group centers 100 whose neighborhood is near convex on the original loss function, i.e., the group centers making the distance between the original and convex loss functions the smallest, as thrust points in the thrust vector control. Since the neighborhood 104 of these thrust points is near convex, finding the optimal 105 parameter (near global minima of model parameters) is de-106 terministic due to the MU, which consistently moves the unlearning gradients toward this minimum and ensures the stability of MU attacks. We theoretically derive the solution 109

of convex polyhedral approximation through constrained optimization.

Second, by utilizing the conjugate algorithm (Ly et al., 2017), the thrust points are mapped to the corresponding parameters in parameter space. Due to the convexity of the neighborhood of the thrust points, the mapping between the thrust points and the corresponding parameters is a one-toone mapping, since the optimal parameter in the parameter space is unique under the convexity condition. We then model the corresponding parameters in parameter space as thrust vectors in the thrust vector control. Following this mapping, an effective simplex detection technique is proposed to build a maximum regular simplex with thrust vectors as vertices. The maximum regular simplex is able to cover the parameter space as much as possible, which allows the model parameter to be moved towards parameters corresponding to any attack targets upon attackers' demands. Like multiple thrusts from the engines on a aircraft or rocket can be adjusted to steer the vehicle in any direction, based on the built maximum regular simplex, by unlearning one or more thrust vectors in parameter space, the model parameter can be moved to handle the parameter change due to arbitrary MU attack requests. We theoretically validate the regularity property of the built maximum regular simplex as well as the coverage of the simplex to the parameter space.

Figure 1 exhibits the workflow of our proposed MU attack algorithm, FESA, with two main stages: poisoned dataset construction and MU attacks. In the first stage, Figure 1 (a) represents the random selection of multiple data samples from the clean instance as the initial group centers. In Figure 1 (b), the group centers whose neighborhood is near convex are selected as the thrust points (red points in Figure 1 (a)) through the convex polyhedral approximation method. In Figure 1 (c), utilizing the conjugate algorithm (Ly et al., 2017), the thrust points in the poisoning dataset are mapped to the thrust vectors (red vertices  $v_1$ - $v_5$  in Figure 1 (c)) in parameter space via the conjugate algorithm. Around these group centers, data samples are generated within the MU budget using a predefined distribution, such as a Gaussian distribution (More & Wolkersdorfer, 2023; Oymak &

Soltanolkotabi, 2021), to construct the poisoning dataset. In 111 the second stage, in Figure 1(d), giving current parameter 112 w, the attacker aims to attack a specific attack target by 113 moving w towards a target parameter  $w_t$ . The deviation 114 from w to  $w_t$  is  $\Delta w = w_t - w$ . To move w to  $w_t$ , the 115 attacker requests the data removal with the direction  $-\Delta w$ 116 by manipulating the thrust vectors (blue vertices  $v_1$  and  $v_3$ ) 117 to control the direction of the vehicle towards  $w_t$ . After 118 addressing this malicious unlearning requests, the attacker 119 can continue to move the parameter from  $w_t$  to others in 120 the parameter space in response to one or more unlearning 121 requests, without sequentially redoing the data poisoning 122 operations and the attack processes one by one.

123 In comparison with existing MU attack techniques, our 124 FESA method exhibits three compelling advantages: (1) It 125 supports the target-agnostic MU attacks by manipulating one or more thrust vectors to move the parameter towards 127 any direction; (2) It provides the timely response to a se-128 ries of MU attack requests, as long as the amount of data 129 removals is below the MU budget; and (3) It ensuring the 130 stability of MU attacks based on convex approximation and 131 optimization. Empirical evaluation on real datasets demon-132 strates the superior performance of our FESA MU attack 133 model against several state-of-the-art methods on image 134 classification. More experiments, implementation details, 135 and hyperparameter setting are presented in Appendices F. 136

# 2. Background

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# 139140**2.1. Machine Unlearning**

141 Machine unlearning is a process designed to ensure that the 142 influence of specific data points is effectively removed from 143 a trained model. Formally, given a training dataset of N 144 samples  $D = \{x_i, y_i\}_{i=1}^N$ , where each data point  $x_i \in \mathbb{R}^d$  is 145 associated with a label  $y_i \in \{1, 2, \dots, Y\}$ , where Y is the 146 number of classes. A classification model M(D) is trained 147 on the complete dataset D. Machine unlearning aims to 148 remove the influence of a subset of data  $D_u \subset D$ , referred 149 to as the forgotten data, such that the updated model behaves 150 as if  $D_u$  were never part of the training process.

When a data removal request is submitted, the dataset is conceptually split into  $D_u$ , the data to be forgotten, and  $D_r$ , the data to be retained, where  $D = D_u \cup D_r$ . The goal of machine unlearning is to ensure that the model obtained after forgetting specific data has a probability distribution equivalent to a model trained without those data points. This can be expressed as:

$$Pr(D \setminus x_f) = Pr(D(X \setminus x_f; Y))$$

A straightforward approach to achieve unlearning is to retrain a new classification model  $M_r(D_r)$  from scratch using only  $D_r$ . This method ensures exact unlearning by completely removing the influence of  $D_u$  from the model. However, retraining is computationally intensive and impractical for large-scale datasets and modern deep learning architectures, making it an inefficient solution.

To address these limitations, efficient algorithms aim to approximate the retrained model  $M_r(D_r)$  directly from the deployed model M(D). The objective is to produce a sanitized model  $M_u(D, D_u, M)$  that eliminates the influence of  $D_u$  while leveraging the existing model M(D), thus avoiding the need for full retraining. By modifying M(D) to remove the impact of  $D_u$ , this approach significantly reduces computational costs while achieving the desired unlearning outcome.

## 2.2. Poisoning-Based Backdoor Attacks

Poisoning-based backdoor attacks inject maliciously crafted data into the training process to implant hidden backdoors in machine learning models. Consider a training dataset  $D = \{x_i, y_i\}_{i=1}^N$ , where each  $x_i \in \mathbb{R}^d$  is associated with a label  $y_i$ . The attacker introduces a poisoned subset  $D_p = \{(x_p, y_t)\}$ , where  $x_p$  contains a trigger, and  $y_t$  is the target label. The poisoned dataset becomes  $D' = D \cup D_p$ . The model M(D') is trained to behave normally on clean inputs  $x_b$ , such that:

$$M(x_b) = y_b, \quad \forall (x_b, y_b) \in D, \tag{2}$$

while misclassifying inputs containing the trigger  $x_t$ :

$$M(x_t) = y_t, \quad \forall x_t \text{ containing the trigger.}$$
(3)

These attacks are stealthy and adaptable, as the poisoned samples are often indistinguishable from benign data. Recent techniques have further enhanced the stealth and robustness of triggers, making poisoning-based backdoor attacks a critical challenge for secure machine learning.

## **3. Dynamic Delayed Poisoning Attack**

#### 3.1. Threat Model

During training at time  $t_0$ , the model learns from a clean dataset  $D_{c1}$ , while the attacker injects a malicious dataset  $D_p$ . Training continues with additional clean data  $D_{c2}$ . At  $t_1 > t_0$ , the attacker submits an unlearning request targeting  $D_u \subset D_p$ , thereby manipulating the model parameters wtoward a desired state  $w_t$ . The target  $w_t$  is determined by searching the neighborhood of w, ensuring the model exhibits the intended adversarial behavior post-unlearning.

No access to training data. The adversary has no direct access to the training data beyond their injected poison samples. This reflects realistic scenarios, such as collaborative open-source projects where users contribute data. In such cases, an adversary can subtly introduce poisoned samples that remain indistinguishable from benign data. Through unlearning requests, these poisoned samples are strategically removed, activating the attack and compromising the model's integrity.

(1)

165Knowledge. The attacker has access to the model archi-166tecture, training process, loss function, and parameters at167a checkpoint  $t_1$ . This assumption is practical, as many168machine learning models are built using well-documented169architectures, open-source libraries, or pre-trained models.170Additionally, APIs for model fine-tuning and interaction171often expose certain model behaviors, which attackers can172exploit.

## 3.2. Thrust-Driven Parameter Manipulation via Simplex Geometry

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176 To address the two key limitations of existing MU attack 177 methods mentioned in Section 1, namely inflexibility due 178 to pre-defined attack targets and inefficiency in handling 179 multiple attack requests, we propose an effective simplex de-180 tection technique based on John's theorem (Lasserre, 2014). 181 This technique constructs a maximal regular simplex us-182 ing thrust vectors (group centers V) as vertices, ensuring 183 that the simplex provides maximal coverage of the param-184 eter space. This property allows model parameters to be 185 dynamically guided toward those corresponding to any attack target specified by the attacker. By unlearning one or 187 more thrust vectors within the parameter space, the model parameters can be adjusted to accommodate the shifts re-189 sulting from arbitrary MU attack requests. Additionally, we 190 provide theoretical validation of the regularity of the con-191 structed maximal regular simplex and its parameter space coverage, demonstrating the robustness and effectiveness of 193 the proposed method.

A regular *n*-simplex (Dirksen, 2015) is an *n*-dimensional regular polytope with n + 1 vertices, where each pair of vertices is connected by an edge. To formally define the simplex and its geometric properties, we present the following: **Definition 3.1** (Simplex). A (n - 1)-simplex  $S_{n-1}$  is the convex hull of *n* affinely independent group centers  $v_1, v_2, \ldots, v_n \in \mathbb{R}^n$ . It is defined as:

$$S_{n-1} = \left\{ s \mid s = \sum_{i=1}^{K} \lambda_i v_i, \ \sum_{i=1}^{K} \lambda_i = 1, \ \lambda_i \ge 0, \ \forall i \right\}$$
(4)

where *n* represents the number of vertices in the simplex. These conditions ensure that  $S_{n-1}$  is a compact and convex subset of  $\mathbb{R}^n$ .

**Definition 3.2.** [Regular n - 1 Simplex] A set of n group centers  $\{\mathbf{v}_1, \mathbf{v}_2, \dots, \mathbf{v}_n\} \subset \mathbb{R}^{n-1}$  forms a regular n-1 sim-209 210 plex if and only if: (1) Centroid Condition: The centroid of the points is at the origin,  $\sum_{i=1}^{n} \mathbf{v}_i = \mathbf{0}$ . (2) Equidistant 211 Condition: The squared Euclidean distance between any 212 213 two distinct points is constant,  $\|\mathbf{v}_i - \mathbf{v}_j\|^2 = d^2$ ,  $\forall i \neq j$ . (3) Inner Product Symmetry: The inner product between 214 any two distinct points is constant,  $\mathbf{v}_i \cdot \mathbf{v}_j = -\frac{d^2}{n-1}$ ,  $\forall i \neq j$ . These conditions ensure that the points are symmetrically 215 216 217 distributed in n-1 dimensions, forming a regular simplex. 218 **Definition 3.3.** [John's Theorem] Let K be a convex body 219

in  $\mathbb{R}^n$ . John's Theorem states that K contains a unique ellipsoid of maximal volume, denoted as  $B_2^n$  (the Euclidean ball of unit radius), if and only if the following conditions are satisfied:

- $B_2^n \subseteq K$ .
- There exist Euclidean unit vectors  $(v_i)_{i=1}^n$  on the boundary of K and positive coefficients  $(c_i)_{i=1}^n$  such that:

$$\sum_{i=1}^{n} c_{i} v_{i} = 0, \text{ and } \sum_{i=1}^{n} c_{i} \langle x, v_{i} \rangle^{2} = \|x\|^{2}, \forall x \in \mathbb{R}^{n}.$$
 (5)

These conditions ensure the uniqueness of the maximalvolume ellipsoid within K, providing a geometric characterization of K through its boundary points.

The following theoretical analysis quantifies the correctness and applicability of our poisoning dataset construction based on the regular simplex. Definitions 3.1–3.3 provide the necessary foundations for the theoretical proofs. Theorems 3.1 and 3.2 establish that the John ellipsoid of a regular simplex is its inscribed sphere. For any simplex in  $\mathbb{R}^n$ , the simplex is regular if and only if its John ellipsoid is the unit ball  $B_2^n$ . Consequently, Theorem 3.3 determines whether multiple group centers form a regular simplex and quantifies the degree of regularity of the simplex. Theorem 3.4 measures the proportion of the effective parameter space occupied by the constructed simplex. Please refer to Appendix C for detailed proof of Theorem 3.1 - 3.4

**Theorem 3.1.** The John ellipsoid of a regular simplex is its inscribed ball. Let A be a regular simplex in  $\mathbb{R}^n$  with vertices  $\{A_1, A_2, \ldots, A_{n+1}\}$  and  $B_2^n$  as its inscribed ball. Denote by  $\{B_i, i = 1, \ldots, n+1\}$  the tangent points which is opposite to  $\{A_i, i = 1, \ldots, n+1\}$  respectivelyy. For positive weights  $c_i = \frac{n}{n+1}$   $(i = 1, \ldots, n+1)$ , the barycentric sum satisfies: n+1

$$\sum_{i=1}^{n+1} c_i B_i = \left(\frac{1}{n+1}, \dots, \frac{1}{n+1}\right)$$
(6)

Additionally, the solution to the representation of any point  $x \in \mathbb{R}^n$  in the simplex is:

$$\alpha = \left(\frac{n}{n+1}\langle u_1, x \rangle, \dots, \frac{n}{n+1}\langle u_{n+1}, x \rangle\right)$$
(7)

where  $\{u_1, \ldots, u_{n+1}\}$  are unit normal vectors.

**Theorem 3.2.** A simplex S in  $\mathbb{R}^n$  is regular if and only if its John ellipsoid is the unit ball  $B_2^n$ . If  $B_2^n$  is the John ellipsoid of S, then  $B_2^n$  must be tangent to each face  $F_i$  of S. Conversely, if S is a regular simplex, its John ellipsoid is necessarily  $B_2^n$ , as the regularity ensures symmetry and equal tangency conditions.

The volume of S satisfies:

$$Vol(S) = \frac{\sqrt{n^n (n+1)^{n+1}}}{n!}$$
 (8)

which is the exact volume of a regular simplex with its inscribed ball being  $B_2^n$ . Furthermore, for the unit normal

vectors  $\{v_i\}_{i=1}^{n+1}$  corresponding to the faces of C, the inner product between any two distinct vectors satisfies:

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$$\langle v_i, v_j \rangle = -\frac{n+1}{n^2}, \quad i \neq j$$
 (9)

This establishes that the regularity of a simplex is directly characterized by the tangency, volume, and inner product properties of its John ellipsoid.

**Theorem 3.3.** A regular simplex can be quantified by how closely it satisfies the conditions of the John ellipsoid. For a given set of group centers  $V = \{v_1, v_2, ..., v_n\}$ , let I denote the identity matrix,  $v_i$  represent individual group centers, and T denote the total number of group centers. Define the regularity measure based on the group centers V as:

$$\phi(V) = \frac{1}{T} \sum_{t=1}^{T} \exp\left(-\frac{\|I - \sum_{i=1}^{n} c_i v_i \otimes v_i\|^2}{2\sigma^2}\right)$$
(10)

where  $\sigma^2 = \frac{1}{2\pi}$  is the variance of the Gaussian function.

The value of  $\phi(V)$  lies in the range [0, 1], where  $\tau(V) = 1$  indicates that the simplex is perfectly regular, satisfying all the conditions of the John ellipsoid. A value closer to 0 reflects higher irregularity due to deviations in the summation conditions.

To ensure the simplex effectively covers the parameter space and provides precise control over model parameters, it must satisfy two criteria: (1) the simplex should be as large as possible, and (2) its centroid should be positioned at the origin. These properties enable the simplex to efficiently and effectively manipulate the parameters in diverse directions.

We achieve these goals by optimizing the following objective function: n

$$\mathbb{E}_{v_1, v_2 \sim V} \|v_1 - v_2\| + \frac{1}{|V|} \sum_{i=1}^{N} v_i, \tag{11}$$

where  $V = \{v_1, v_2, \ldots, v_n\}$  represents the set of group centers. The first term maximizes the distance between randomly sampled pairs of group centers  $v_1$  and  $v_2$ , ensuring the simplex is as large as possible. The second term minimizes the sum of the group centers' distances to the origin, ensuring the centroid of the simplex lies at the origin.

Thus, our overall optimization objective is defined as:

$$L_s = -\phi(V) - \mathbb{E}_{v_1, v_2 \sim V} \|v_1 - v_2\| + \frac{1}{|V|} \sum_{i=1}^{N} v_i, \quad (12)$$

where  $\phi(V)$  quantifies the regularity of the simplex formed by the group centers  $V = \{v_1, v_2, \dots, v_n\}$ .

Due to the lack of access to the training data, we cannot determine the size of the effective parameter space beforehand. However, through theoretical analysis, the following theorem quantifies the proportion of the effective parameter space occupied by the constructed simplex.

**Theorem 3.4.** Following (Li et al., 2015; Pearce et al., 2020; de G. Matthews et al., 2018), assume the parameter space

follows a Gaussian distribution in  $\mathbb{R}^d$ . The proportion of the effective parameter space (PS) occupied by the constructed (n-1)-dimensional simplex (S)is:

$$\rho = \frac{Vol(S)}{Vol(EPS)} = \frac{\sqrt{n+1}\Gamma\left(\frac{m}{2}+1\right)}{(n-1)!\,l\,\pi^{m/2}\sqrt{2}\sigma^m} \tag{13}$$

where  $\Gamma$  is the Gamma function,  $\sigma$  represents the standard deviation of the Gaussian distribution defining the spread of the parameter space, m is the dimensionality of the Gaussian parameter space, and l is the edge length of the constructed simplex.

### 3.3. Handling Instability in Non-Convex Loss via Convex Polyhedral Approximation

The non-convexity of the loss function in training models poses a fundamental challenge for existing machine unlearning attack methods, as they are all susceptible to local minima, which can lead to deviations from the intended attack outcomes and significantly reduce attack success rates. In our scenario, this issue is particularly critical, as it introduces instability in the behavior of the constructed thrust vectors (group centers), making parameter updates unpredictable and difficult to control. In contrast, if the loss function L(f(w, x), y) were convex, it would possess a unique minimum for each data sample x, ensuring that unlearning gradients consistently converge toward the intended update direction. However, directly enforcing convexity in the original loss function is infeasible, as it would severely degrade the model's performance, and model owners have no incentive to modify their model structure to accommodate external requests.

To mitigate instability, we propose we propose a convex polyhedral approximation method that transforms the original non-convex loss function  $L_d(w)$  into its convex counterpart  $L'_d(w)$ . Our objective is to identify multiple group centers in the neighborhood of the original loss function that exhibit the smallest deviation from its convex approximation, ensuring that they are as close as possible to the convex regions of  $L_d(w)$  These group centers act as thrust points in thrust vector control, guiding parameter updates during unlearning. Since these thrust points lie in regions where the loss function is nearly convex, the optimization process under machine unlearning (MU) becomes more predictable. This allows the unlearning gradients to reliably push the model parameters toward an optimal state, ensuring a stable and effective MU attack.

By adopting this approach, we carefully position the thrust vectors (group centers) at these optimized data points. This ensures stable and predictable behavior of the thrust vectors, enabling precise manipulation of model parameters and significantly enhancing attack effectiveness.

**Definition 3.4** (Convex Polyhedron of a Function). The convex polyhedron of a function  $L_d(w)$  is defined as the

275 intersection of all half-spaces in  $\mathbb{R}^n$  that lie above the graph of  $L_d(w)$ . Formally, for a function  $L_d : \mathbb{R}^n \to \mathbb{R}$ , the convex polyhedron P is given by: 276 277

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$$P = \{(w, z) \in \mathbb{R}^n \times \mathbb{R} \mid \\ z \ge L_d(w) + \nabla L_d(w)^\top (w' - w), \, \forall w' \in \mathbb{R}^n\}$$
(14)

280 where z represents the vertical coordinate in  $\mathbb{R}^{n+1}$ , and the 281 inequality ensures that P captures the convex hull of  $L_d(w)$ . 282 This formulation represents the set of points lying above the 283 epigraph of  $L_d(w)$  in  $\mathbb{R}^{n+1}$ , forming a convex polyhedron. 284 Definition 3.5 (Caratheodory's theorem). Given a polytope 285  $P \subset \mathbb{R}^n$  and a lower semi-continuous function  $L_d(w)$ , the 286 convex envelope of  $L_d(w)$  at a point  $w \in P$  is defined as : 287

$$\operatorname{Conv}_{L,P}(\mathbf{w}) = \min\left\{\sum_{i=1}^{n+1} \lambda_i L(\mathbf{Q}_i) : \mathbf{Q}_i \in P, \\ i = 1, \dots, n+1, \sum_{i=1}^{n+1} \lambda_i = 1, \sum_{i=1}^{n+1} \lambda_i \mathbf{Q}_i = w, \, \lambda_i \ge 0\right\}$$
(15)

292 Here,  $\lambda_i$  represents the barycentric coordinates associated 293 with the points  $\mathbf{Q}_i$ , ensuring that the convex combination 294 satisfies the conditions of w being in P. 295

296 Convex polyhedral envelopes are not necessarily differen-297 tiable at optimal points, making gradient-based optimization 298 infeasible. Moreover, finding the convex envelope of a gen-299 eral function g over a region P is computationally challeng-300 ing. It has been proven (Guo et al., 2023) that determining 301 the convex envelope of multilinear functions over the unit 302 hypercube is an NP-hard problem. 303

To address this, we adopt a pointwise supremum approach 304 based on underestimating affine functions of g over P. The 305 convex envelope at any point is determined by solving a 306 constrained optimization problem. 307

**Theorem 3.5.** Let g be a convex function defined over a 308 polytope P, and let  $(x_0, y_0) \in P$  be a reference point. 309 The convex envelope of g at  $(x_0, y_0)$  is the solution to the 310 optimization problem: 311

where  $V'(P) \subseteq V(P)$  denotes the subset of vertices of P 318 319 that do not belong to edges in E'(P), and E'(P) represents 320 the set of edges of P along which L(x, y) is strictly convex.

321 In the vertex constraints,  $L(x_i, y_i)$  ensures that the affine 322 function defined by a, b, and c underestimates L(x, y) at 323 each vertex. In the edge constraints,  $L(x, m_i x + q_i)$  en-324 forces the underestimation of L(x, y) along each edge  $e_i$ , 325 where  $m_j$  and  $q_j$  describe the edge as a linear function  $y = m_i x + q_i$ . The strict convexity of f ensures that the 327 minimum value over an edge occurs either at its endpoints 328 or at a critical point within the interval. 329

Thus, our optimization objective is defined as:

$$L_{t} = \sum_{x \in G} \max_{w \in S_{V}} \left| L_{x}(w) - L'_{x}(w) \right|$$
(17)

where  $L_x(w)$  represents the original loss function parameterized by the data sample x, and  $L'_x(w)$  denotes its convex approximation. Here,  $S_V$  is the polytope formed using V as the vertices, and G is the set of the group centers.

This formulation ensures that we identify a set of data samples d such that  $L_d(w)$  approximates a convex function as closely as possible. To ensure the model behaves predictably during unlearning, the group centers are carefully positioned on these optimized data points. This placement reduces instability caused by the non-convexity of the loss function and ensures the parameters are adjusted smoothly and effectively throughout the process.

By assembling different pieces together, we provide the pseudo code of our DDPA method in Algorithm 1 in Appendix D.

## 4. Experimental Evaluation

In this section, we evaluate the effectiveness of our Dynamic Delayed Poisoning Attack (DDPA) method compared to several state-of-the-art machine unlearning robustness attack methods. Through comprehensive experiments on multiple representative classification tasks, we demonstrate that DDPA achieves a significantly higher attack success rate across various settings. Please refer to the appendixF for detailed experimental settings and additional results.

Datasets and Models. We conduct experiments on two widely-used image classification datasets and one sentiment classification dataset: CIFAR-100 (Krizhevsky, 2009), Tiny ImageNet (Le & Yang, 2015), and SST-2 (Socher et al., 2013). The classifiers are trained on their respective training sets and evaluated on their test sets. For CIFAR-100, we use the VGG16 (Simonyan & Zisserman, 2015) model for image classification. On Tiny ImageNet, we train ResNet-18 (He et al., 2015) for image classification. For sentiment classification on SST-2, we fine-tune LLaMA-3B (Grattafiori et al., 2024) using LoRA. The detailed descriptions of the datasets and models are presented in Appendix F.

Baselines. We compare DDPA with nine state-of-the-art machine unlearning attack methods. AwoP (Liu et al., 2024) amplifies trigger effects by injecting them into the frequency domain and requesting selective instance removal. MUECPA (Di et al., 2024) introduces poison and camouflage points to evade detection. SSCSF (ZHAO et al., 2023) optimizes crafted data update requests to exploit unlearning vulnerabilities. BAU (Zhang et al., 2023) conceals backdoors with mitigation samples and reactivates them via unlearning. UBA-inf (Huang et al., 2024b) enhances stealth and attack efficacy using label correction and influ-

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		Table	e 1. U	nlearn	ing Pe	rform	ance o	n VG	G-16 v	with C	IFAR	100 (5	% Un	learne	d)		
0	Method	B/A Unlearn	Fi	rst-Ord	er	Sec	ond-Or	der	Uı	roll-SC	5D	A	mnesia	c		SISA	
1	wieniou	B/A Unicarn	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR
2	AwoP	Conceal	98.98	48.05	22.60	98.89	49.08	17.30	98.54	49.33	14.90	98.46	50.33	20.70	98.98	49.90	15.32
2	71001	Unlearn	97.64	47.00	86.00	97.21	47.74	89.00	97.37	47.42	85.00	96.90	46.67	85.00	97.81	46.48	65.00
)	MUECPA	Conceal	98.02	55.14	0.00	98.26	49.10	0.00	98.04	49.42	0.00	98.27	49.28	0.00	98.33	49.38	0.00
		Unlearn	95.01	46.43	80.40	97.25	47.54	88.10	97.19	47.37	86.80	96.54	45.95	82.20	97.20	47.10	85.38
	SSCSF	Conceal	99.98	47.75	0.00	99.95	47.73	0.00	99.78	49.67	0.00	99.58	49.38	0.00	98.75	47.80	0.00
		Unlearn	98.72	45.07	80.00	97.39	47.75	90.00	97.46	47.43	86.93	97.17	44.82	88.00	97.22	45.51	86.26
	BAU	Conceal	98.24	46.38	0.00	98.06	43.64	0.00	98.04	46.42	0.00	98.53	47.30	0.00	98.68	47.26	0.00
		Unlearn	96.28	44.73	80.00	96.56	45.42	/8.00	97.90	43.17	16.57	96.98	42.73	/9.80	97.45	45.20	80.00
	UBA-Inf	Unloam	98.30	54.41	13.00	96.65	54.67	9.15	96.97	52.40	24.09	96.54	50.80	15.10	96.40	J1.27 46.26	10.27
		Conceal	97.23	J4.41 47 73	0.00	97.34	47.14	0.00	97.41	17.83	04.90	90.08	17 80	0.00	90.24	40.20	0.00
	RMBMU	Unlearn	95.28	46.24	85.00	96.38	46.67	86.00	96.76	45.40	84 38	95.02	44.89	85.00	96.90	45.25	86 74
		Conceal	98.46	48 74	0.63	98.16	48.02	0.13	98 39	48 97	0.52	98.88	48.04	0.00	98.28	48 14	0.67
	DABF	Unlearn	97.64	46.69	86.00	97.47	47.68	81.21	97.24	45.48	85.00	96.81	42.44	87.11	97.14	46.14	84.45
		Conceal	98.86	46.37	0.00	98.55	47.14	0.00	98.73	47.73	0.00	98.49	47.44	0.00	98.56	47.19	0.00
	AdvUA	Unlearn	96.49	45.29	80.20	96.38	45.42	85.52	97.07	45.39	83.57	96.63	45.57	85.34	96.69	45.83	83.68
	EVALUE	Conceal	99.37	51.71	0.00	98.89	50.70	0.28	98.31	50.51	0.37	98.60	51.02	0.33	98.79	46.02	1.89
	EVMUS	Unlearn	98.97	50.62	79.20	96.07	46.99	81.77	97.90	46.36	67.66	94.31	47.62	73.61	97.29	45.36	79.26
		Conceal	96.97	48.26	0.00	96.87	48.74	0.00	98.36	48.64	0.00	98.27	47.11	0.00	98.45	47.76	0.00
	DDIA	Unlearn	94.54	44.09	92.00	95.60	44.43	91.00	97.89	44.25	88.00	95.48	41.56	89.40	95.81	43.18	89.69
	DDPA-C	Conceal	97.57	48.60	0.00	96.77	47.13	0.00	98.23	47.55	0.00	97.85	46.65	0.00	97.92	46.32	0.00
	DDINC	Unlearn	95.45	45.58	80.00	95.35	45.93	80.20	96.86	46.86	80.40	95.58	43.59	81.20	95.16	44.11	80.60
	DDPA-S	Conceal	96.42	48.37	0.00	96.90	47.38	0.00	98.19	47.33	0.00	98.63	46.42	0.00	98.01	46.06	0.00
		Unlearn	95.70	45.18	81.30	95.30	45.15	82.30	96.16	45.58	81.60	96.46	43.53	82.40	95.65	44.75	81.90

350 ence functions. RMBMU (Ma et al., 2024) unlearns infor-351 mative benign data to destabilize the model. DABF (Shin & 352 Park, 2024) injects and conceals backdoors to bypass detec-353 tion. AdvUA (Zhao et al., 2024) selects unlearning samples 354 near victim samples to maximize adversarial impact. EV-355 MUS (Hu et al., 2024) moves data to decision boundaries to 356 maximize unlearning effects. To the best of our knowledge, 357 this work is the first to determine attack targets during the 358 unlearning phase, enabling arbitrary target attacks and mul-359 tiple attacks within the unlearning data budget. For detailed 360 descriptions of each baseline, please refer to the appendix 361 Α.



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*Figure 2.* VGG-16 + CIFAR-100 (5 Unlearning Request) Time Comparison

375 Evaluation Metrics. We evaluate the performance of the 376 attack based on the attack success rate (ASR), defined as the percentage of inputs that were successfully manipulated to 378 achieve the objective of the adversary. For targeted attacks, 379 ASR measures the proportion of samples misclassified into 380 the target class. For untargeted attacks, ASR quantifies 381 the proportion of samples misclassified into any incorrect 382 class. In addition, we measure test accuracy (BA) and train 383 accuracy (TA) degradation on benign inputs to assess the 384

collateral impact on model performance.

Variants of DDPA method. We evaluate two variants of DDPA to highlight the advantages of different techniques. DDPA-S utilizes only the simplex method to maximize and generate an effective operational space. DDPA-C employs only Convex Polyhedral Approximation to ensure stability in constructing thrust vectors (group centers). DDPA operates with the full support of both simplex method and convex polyhedral aooriximation.

Attack performance on various dataset with different unlearning algorithms. Table 1 presents the TA, BA and ASR scores of five machine unlearning algorithms evaluated on test data arcoss 12 attack models. For each attack model we reserve 5%, 10% and 20% of the training dataset as the attack dataset. The conceal setting represents the evaluation before the unlearning attack, while unlearn refers to the results after the attack is applied.For targeted attacks, we observe that across all 12 attack methods, DDPA maintains an ASR of 0 before unlearning, while achieving relatively high test accuracy in most cases, even without data augmentation. This indicates that the poisoning dataset constructed by DDPA is highly stealthy. After the unlearning attack, DDPA achieves the highest ASR and the lowest BA, demonstrating its effectiveness in executing a successful attack. Compared to other attack models across the five machine unlearning algorithms, DDPA achieves an average ASR increase of 22.74%, 16.07%, and 21.45%, while reducing BA by 15.76%, 11.41%, and 2.27% on VGG16-CIFAR100, ResNet18-Tiny-ImageNet, and LLaMA-3B-SST-2 respectively. In addition, the promising performance of DDPA with all machine unlearning algorithms implies that DDPA has greate potential as a general attack solution to other machine unlearning methods, which is desirable in practice.

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*Figure 4.* Time comparison for different methods in the ablation study.

executes multiple attacks across different datasets with minimal time cost. Compared to other methods, DDPA achieves the lowest running time, demonstrating its scalability and efficiency in multi-target attack scenarios.

Ablation study. Figure 4 presents the attack performance of two DDPA variants across five unlearning algorithms on CIFAR-100, Tiny-ImageNet, and SST-2. We observe that the full DDPA method achieves the lowest BA and the highest ASR in both targeted and untargeted attack settings, consistently outperforming other versions. A reasonable explanation is that our simplex method effectively maximizes the operational space while minimizing computational complexity, allowing for precise and efficient control of parameter manipulation during unlearning. In addition, our Convex Polyhedral Approximation stabilizes the behavior of thrust vectors (group centers) by mitigating the impact of loss function non-convexity, ensuring that parameter updates follow a structured and predictable trajectory.

**Impact of Unlearning Ratio** Figure 3 evaluates the impact of the unlearning ratio on ASR, ranging from 5% to 20% across CIFAR-100, Tiny-ImageNet, and SST-2. We observe that ASR increases as the percentage of unlearned samples grows, as larger unlearning sets amplify the disturbance to model parameters, making them more susceptible to attack. Notably, our method consistently achieves the highest ASR across all unlearning ratios, outperforming all other baselines.

# 5. Conclusions

In this work, we proposed a novel attack framework for machine unlearning (MU) that introduces a target-agnostic, ondemand attack strategy, enabling adversaries to dynamically specify arbitrary targets and efficiently execute multiple attack requests post-deployment. First, we leverage convex polyhedral approximation to identify stable group centers. Second, we employ the simplex method to construct a regular simplex over the group centers, maximizing parameter space coverage and allowing precise control over attack trajectories. Finally, we theoretically analyze the proportion of the parameter space occupied by the constructed simplex, providing guarantees on its effectiveness in guiding MU attacks.



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408 409 Evaluation of target-agnostic attack performance. Figure 5 evaluates the flexibility of our method in a target-410 agnostic attack setting, where the attack target is unknown 411 during the construction of the poisoned dataset. Since other 412 413 attack methods require predefining a single target during 414 poisoning and cannot adjust the target during the unlearning attack phase, we relax this constraint for comparison. 415 Specifically, we assume they have prior knowledge of 5, 416 10, or 20 potential target classes, forcing them to distribute 417 their poisoning budget across all potential targets rather than 418 focusing on a single one. As the number of potential target 419 classes increases, we observe a significant drop in ASR for 420 other attack methods, while DDPA maintains a high ASR. 421 In the targeted attack setting, DDPA achieves a maximum 422 ASR of 88.3%, whereas the lowest ASR among other meth-423 ods is 5.9%. In the untargeted attack setting, DDPA reaches 424 91.6% ASR, while the lowest-performing method achieves 425 only 6.3%. These results demonstrate DDPA's flexibility in 426 adapting to different attack targets, allowing it to effectively 427 execute unlearning attacks against any target. 428

429 Running time with multi-attacks Figure 2 evaluates the ef-430 ficiency of our method in executing multiple attacks within 431 a predefined poisoning budget. The attacker submits 2, 3, 432 or 5 unlearning requests, each targeting a different attack 433 objective. Since other attack methods predefine a single 434 target and cannot dynamically adjust to multiple attacks, 435 they must reconstruct a new poisoned dataset for each target, 436 leading to significant time overhead. In contrast, DDPA 437 uses a single pre-constructed dataset, eliminating the need 438 for additional poisoning steps. As a result, DDPA efficiently 439

## 440 Impact Statement

441 In this work, the two image datasets and one NLP dataset are 442 all open-released datasets (Krizhevsky, 2009; Le & Yang, 443 2015; Socher et al., 2013), which allow researchers to use for 444 non-commerical research and educational purposes. These 445 three datasets are widely used in training/evaluating the 446 machine unlearning. All baseline codes are open-accessed 447 resources that are from the GitHub and locensed under the 448 MIT License, which only requires preservation of copy-449 right and license notices and includes the permissions of 450 commercial use, modification, distribution, and private use. 451

452 To the best of our knowledge, this work is the first to intro-453 duce a dynamic delayed poisoning attack (DDPA) frame-454 work specifically designed for machine unlearning sys-455 tems. Unlike existing methods, which require the prede-456 fined choice of attack targets during the poisoning dataset 457 construction phase, our approach offers dynamic flexibil-458 ity by delaying the selection of backdoor triggers and tar-459 geted attack objectives until after model training. Inspired 460 by thrust vector control, a technique widely employed in 461 aerospace engineering, our method strategically organizes 462 data samples as "propellers" to manipulate model parame-463 ters efficiently during the unlearning process. Furthermore, 464 we leverage convex polyhedral approximations to stabilize 465 the loss function and ensure precise control over parameter 466 updates, mitigating the unpredictable behavior introduced 467 by non-convexity.

468 Our framework can play a critical role in evaluating and 469 fortifying the robustness of machine unlearning systems, 470 which are increasingly integrated into privacy-sensitive ap-471 plications such as autonomous vehicles, healthcare analytics, 472 and personalized AI systems. While primarily theoretical, 473 we expect our findings to provide valuable insights into 474 the vulnerabilities of unlearning systems and inspire the 475 development of robust defense mechanisms. This paper 476 is expected to produce a positive impact by improving the 477 understanding of adversarial risks in unlearning scenarios, 478 without posing immediate societal risks such as security, 479 privacy, or fairness concerns. 480

481 An important contribution of this paper is the development 482 of a geometry-driven poisoning strategy that dynamically 483 adapts to changing adversarial objectives. By combining 484 simplex-based data organization and convex approximation 485 techniques, we ensure that the poisoning dataset remains 486 highly effective across various unlearning configurations. 487 Theoretical analysis supports the efficiency of this approach, 488 with our findings showing significant attack success rates 489 under strict data removal budgets. This work not only un-490 derscores the need for robust defenses against adversarial 491 exploitation but also provides a foundation for future re-492 search in adversarial unlearning scenarios.

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# 825 A. Related Work

Machine Unlearning. Machine unlearning, also known as selective forgetting (Cao & Yang, 2015; Golatkar et al., 2020a;
Shibata et al., 2021) or data removal/deletion (Ginart et al., 2019; Guo et al., 2023), focuese on eliminating the influence of
specific subsets of training data on a pre-trained model (Garg et al., 2020a; Gupta et al., 2021; Nguyen et al., 2022; Wu et al.,
2022). Current methods for machine unlearning can be broadly categorized into two main approaches, as outlined below.

831 (1) Exact machine unlearning algorithms aim to produce a model that performs identically to one trained from scratch, 832 entirely excluding the data to be forgotten. The most straightforward approach, known as naive retraining, involves removing 833 the data to be unlearned and retraining the model from scratch. However, this method incurs substantial computational and 834 time costs. A notable exact unlearning method is Sharded, Isolated, Sliced, and Aggregated training (SISA) (Bourtoule et al., 835 2021). In SISA, the original training dataset is partitioned into multiple disjoint shards, with each training instance assigned 836 to only one shard. Upon receiving an unlearning request, the model onwer retrains only the shard containing the affected 837 data, significantly reducing retraining costs. The final prediction for a given instance is derived by aggregating predictions 838 from all isolated shard models. Recent research has introduced innovative techniques to further enhance the efficiency and 839 performance of exact unlearning. Methods such as dataset partitioning mechanisms and the use of lightweight adapters have 840 been proposed to reduce the computational overhead while maintaining high accuracy (Chowdhury et al., 2024; Aldaghri 841 et al., 2020; Yan et al., 2022; Kumar et al., 2022; Dukler et al., 2023; Golatkar et al., 2023; Pratama & Gambetta, 2024; 842 Yang et al., 2024).

843 (2) Approximate machine unlearning methods aim to efficiently approximate the removal of specific training data's influence 844 on a model without retraining from scratch. Notable approaches include first-order and second-order based unlearning 845 methods (Warnecke et al., 2023), both of which transform changes in training data into closed-form parameter updates 846 to derive the unlearned model. First-order methods leverage the first-order Taylor series expansion of the model, while 847 second-order methods employ the inverse Hessian matrix of second-order derivatives to adjust the parameters. Another 848 noteworthy method is UnrollSGD (Thudi et al., 2022), which formulates a gradient-based unlearning technique by extending 849 a sequence of stochastic gradient descent (SGD) updates through a Taylor series. To reverse the effect of the unlearning 850 data during the SGD stPS, this method adds the gradients of the unlearning data, computed with respect to the initial model 851 weights, to the final model weights. Additionally, Amnesiac unlearning method (Graves et al., 2020) selectively reverses 852 parameter updates associated with sensitive data by tracking which examples appeared in each training batch, providing a 853 time-efficient mechanism with minimal impact on the model's overall performance. Recent research has introduced several 854 innovative techniques to further improve the efficiency and effectiveness of approximate unlearning. For instance, methods 855 based on influence functions estimate the impact of removing a specific data point by leveraging approximations, enabling 856 computationally efficient adjustments to the model (Guo et al., 2023; Sekhari et al., 2021; Suriyakumar & Wilson, 2022; 857 Mehta et al., 2022; Wu et al., 2022; Tanno et al., 2022). Re-optimization techniques iteratively fine-tune the model after 858 data removal, ensuring that the influence of the data is eliminated while maintaining overall performance (Zhang et al., 859 2024; Park et al., 2024; Golatkar et al., 2020a;b; 2021). Gradient update methods incrementally adjust model parameters 860 to account for the addition or removal of data points, providing a lightweight and scalable solution (Huang et al., 2024a; 861 Hoang et al., 2023; Neel et al., 2020a; Gu et al., 2024; Cao et al., 2022; Neel et al., 2020b; Liu et al., 2022). Additionally, 862 graph unlearning addresses the challenges posed by graph-structured data, where inherent dependencies between nodes and 863 edges require tailored strategies to forget specific elements without disrupting the graph's structure (Li et al., 2024; Wu et al., 864 2023a; Zhang, 2024; Yi & Wei, 2024;?; Wu et al., 2023b; Cheng et al., 2023; Chien et al., 2023). 865

866 Poisoning-based Backdoor Attacks. Poisoning-based backdoor attacks aim to embed hidden backdoors into machine 867 learning models by manipulating the training data. In this work, we focus on the problem of poisoning attacks, which 868 involve modifying the training data to implant backdoors into the model. A model compromised through such an attack 869 functions normally on benign inputs but consistently misclassifies inputs containing a specific trigger pattern to the attacker's 870 desired target class (Gu et al., 2019; Chen et al., 2017; Nguyen & Tran, 2020; Zeng et al., 2022; Barni et al., 2019; Li et al., 871 2021a; Liu et al., 2018; Nguyen & Tran, 2021; Liu et al., 2020; Sarkar et al., 2020; Li et al., 2021b; Liao et al., 2018; Tan & 872 Shokri, 2020; Cheng et al., 2021; Garg et al., 2020b; Bauman et al., 2018; Yao et al., 2019; Bagdasaryan & Shmatikov, 873 2021; Yang et al., 2022). These attacks typically involve the injection of poisoned samples into the training dataset, where 874 each poisoned sample contains the predefined trigger. Consequently, the model learns to associate the trigger pattern with 875 the target class during training, resulting in backdoor behavior at the testing stage when the same trigger pattern is present. 876 Recent research on poisoning-based backdoor attacks can be categorized based on the type of triggers, the domain of 877 application, and the optimization strategies employed. For trigger design, studies have proposed a variety of approaches, 878 including adversarial noise combined with indiscriminate poisoning (Yu et al., 2024), kernel-based transformations (Gong 879

et al., 2024), autoencoder-generated triggers (Xue et al., 2024), and low-frequency perturbations (Qiao et al., 2024). Other 880 881 works emphasize invisibility and robustness by leveraging singular value decomposition (SVD) to embed imperceptible 882 backdoors (Chen & Xu, 2024) or exploiting natural phenomena, such as fog (Ni et al., 2023), to seamlessly integrate 883 triggers into the data. In terms of domain-specific applications, approaches like image scaling (Wu et al., 2023c) and deep 884 steganography focus on vision tasks, while IQ sequence-based attacks target wireless communication systems (Huang et al., 885 2023). Backdoor attacks in generative models, targeting components like tokenizers or the language model (Vice et al., 886 2023), further extend the scope of these threats. Optimization-driven methods refine the effectiveness and stealthiness of 887 attacks, including bi-level optimization with sparsity constraints (Gao et al., 2024), dynamic algorithms for manipulating 888 decision boundaries (Ma et al., 2023), and gradient-based trigger generation techniques (Zhao et al., 2023). Additionally, 889 innovative strategies have introduced physical-world triggers, such as uniform color space shifts (Jiang et al., 2023) and 890 backdoor patches designed for camera inputs (Yuan et al., 2023). Some studies focus on enhancing attack stealth through 891 natural integration of triggers or propose multi-stage frameworks that optimize attack success rates while maintaining high 892 robustness (Rathbun et al., 2024b:a).

Attacks on Machine Unlearning. Machine unlearning focuese on removing the influence of specific data from a trained model, as discussed earlier. However, existing work on machine unlearning often overlook the risks associated with malicious unlearning requests, which can lead to model misclassifications. Recent studies have begun to explore the vulnerabilities introduced during the unlearning process and propose novel attack strategies that exploit these weaknesses.

For instance, AwoP introduces backdoor attacks by injecting triggers into the frequency domain of images and submitting malicious unlearning requests to amplify the backdoor effect, causing misclassification of triggered inputs (Liu et al., 2024). MUECPA leverages camouflage datapoints to obscure the impact of poisoned datasets, making them more challenging to detect during training (Di et al., 2024). SSCSF explores selective forgetting attacks, addressing both static scenarios—where all malicious requests are submitted simultaneously—and sequential scenarios optimized through stochastic control frameworks (ZHAO et al., 2023). Another approach, BAU, constructs poisoned and mitigation samples to train a seemingly benign model, later exploiting unlearning requests to activate backdoors gradually (Zhang et al., 2023).

905 Innovative methods such as UBA-Inf use label correction and influence functions to create camouflage samples, enhancing 906 both stealth and attack performance (Huang et al., 2024b). RMBMU takes a different approach by unlearning well-prepared 907 benign data, causing a sudden collapse in model performance due to its reliance on these contributions during training (Ma 908 et al., 2024). DABF employs a two-phase strategy to inject and temporarily conceal backdoors, reactivating them after partial 909 model updates (Shin & Park, 2024). AdvUA aligns unlearning samples with adversarial directions, increasing the model's 910 vulnerability to targeted attacks (Zhao et al., 2024). Finally, EVMUS amplifies the impact of unlearning by strategically 911 moving data points to the model's decision boundary, maximizing the effect on the model's predictive capability (Hu et al., 912 2024). 913

While these approaches demonstrate the growing sophistication of attacks on machine unlearning, they share several limitations. Most require a predefined target when constructing the poisoning dataset, preventing flexibility in adapting attack objectives during the unlearning phase. Furthermore, these methods typically target a single objective and cannot attack multiple targets within a given unlearn data budget. Additionally, many rely on access to the training dataset, which may not always be feasible. Our proposed method effectively addresses these limitations by enabling adaptive multi-target attacks within a constrained unlearn data budget while eliminating the dependency on direct access to the training dataset.

# C. Proof of Theorems

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3.1 provides a way to represent the position of a point relative to a simplex using barycentric coordinates.

**Definition 3.1** (Barycentric Coordinates in a Simplex). Let A be an n-dimensional simplex in  $\mathbb{R}^n$ , with vertices denoted as  $\{A_1, A_2, \ldots, A_{n+1}\}$ , and let M be any point in  $\mathbb{R}^n$ . Define  $V_i$  for  $i = 1, \ldots, n+1$  as the volume of the simplex formed by replacing the *i*-th vertex of  $\{A_1, A_2, \ldots, A_{n+1}\}$  with M. The barycentric coordinates of M with respect to the simplex are given as the ratios:

$$V_1:V_2:\cdots:V_{n+1}.$$

If the dimensions of the convex hulls  $conv\{A_1, \ldots, A_{i-1}, M, A_{i+1}, \ldots, A_{n+1}\}$  and  $conv\{A_1, \ldots, A_{n+1}\} \cap A$  are both n, the above ratios uniquely define the location of M relative to the simplex.

Furthermore, suppose A is a regular simplex, and let  $B_2^n$  denote its inscribed ball. Denote the tangent points of  $B_2^n$  with

each face of A by  $\{B_i : i = 1, ..., n + 1\}$ . If the vertices of A are  $\{A_1, ..., A_{n+1}\}$ , the barycentric coordinates of each tangent point  $B_i$ , with respect to the simplex vertices, are given by:

$$\left(\frac{1}{n},\ldots,\frac{1}{n},0,\frac{1}{n},\ldots,\frac{1}{n}\right),\,$$

where the 0 appears in the *i*-th position (corresponding to the vertex  $A_i$ ) and all other components are  $\frac{1}{n}$ .

**Theorem 3.1.** The John ellipsoid of a regular simplex is its inscribed ball. Let A be a regular simplex in  $\mathbb{R}^n$  with vertices  $\{A_1, A_2, \dots, A_{n+1}\}$  and  $B_2^n$  as its inscribed ball. Denote by  $\{B_i, i = 1, \dots, n+1\}$  the tangent points which is opposite to  $\{A_i, i = 1, \dots, n+1\}$  respectivelyy. For positive weights  $c_i = \frac{n}{n+1}$   $(i = 1, \dots, n+1)$ , the barycentric sum satisfies:

$$\sum_{i=1}^{n+1} c_i B_i = \left(\frac{1}{n+1}, \dots, \frac{1}{n+1}\right)$$
(18)

Additionally, the solution to the representation of any point  $x \in \mathbb{R}^n$  in the simplex is:

$$\alpha = \left(\frac{n}{n+1}\langle u_1, x \rangle, \dots, \frac{n}{n+1}\langle u_{n+1}, x \rangle\right)$$
(19)

where  $\{u_1, \ldots, u_{n+1}\}$  are unit normal vectors.

 *Proof.* According to Definition 3.3, to prove that the John ellipsoid of a regular simplex is its inscribed ball, we verify two key properties: the barycentric sum of the tangent points and the representation of any point  $x \in \mathbb{R}^n$  within the simplex.

Let A be a regular simplex in  $\mathbb{R}^n$  with vertices  $\{A_1, A_2, \dots, A_{n+1}\}$ , and let  $B_2^n$  denote its inscribed ball. Denote the tangent points of  $B_2^n$  opposite to  $\{A_i\}$  as  $\{B_i, i = 1, \dots, n+1\}$ . The barycentric coordinates of  $B_i$  are:

$$B_i = \left(\frac{1}{n}, \dots, \frac{1}{n}, 0, \frac{1}{n}, \dots, \frac{1}{n}\right),\,$$

where 0 occupies the *i*-th position. Clearly, the barycentric coordinates of the origin are:

$$\left(\frac{1}{n+1},\ldots,\frac{1}{n+1}\right).$$

Let  $c_i = \frac{n}{n+1}$  for  $i = 1, \ldots, n+1$ . Then, we have:

$$\sum_{i=1}^{n+1} c_i B_i = \left(\frac{1}{n+1}, \dots, \frac{1}{n+1}\right)$$

This confirms the barycentric sum property.

974 Next, we examine the representation of points within the simplex. For any  $x \in \mathbb{R}^n$ , it holds that: 

$$x = \sum_{i=1}^{n+1} c_i \langle x, u_i \rangle u_i,$$

where  $c_i = \frac{n}{n+1}$ . Since A is an n-dimensional simplex, the n+1 vectors  $\{u_1, u_2, \ldots, u_{n+1}\}$  span  $\mathbb{R}^n$ , i.e.,

$$\operatorname{span}\{u_1, u_2, \dots, u_{n+1}\} = \mathbb{R}^n$$

983 Define  $\alpha = (\alpha_1, \dots, \alpha_{n+1})$  and  $\beta = (\langle u_1, x \rangle, \dots, \langle u_{n+1}, x \rangle)$ . The matrix D is defined as: 

$$D = \begin{bmatrix} \langle u_1, u_1 \rangle & \langle u_1, u_2 \rangle & \dots & \langle u_1, u_{n+1} \rangle \\ \langle u_2, u_1 \rangle & \langle u_2, u_2 \rangle & \dots & \langle u_2, u_{n+1} \rangle \\ \vdots & \vdots & \ddots & \vdots \\ \langle u_{n+1}, u_1 \rangle & \langle u_{n+1}, u_2 \rangle & \dots & \langle u_{n+1}, u_{n+1} \rangle \end{bmatrix}.$$

 $D\alpha^{\top} = \beta^{\top}.$ 

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Each element  $\langle u_i, u_j \rangle$  represents the cosine of the angle between the outer normal vectors  $u_i$  and  $u_j$ . Denote by  $F_i$  and  $F_j$ the faces whose outer normal vectors are  $u_i$  and  $u_j$ , respectively. The dihedral angle  $\angle(F_i, F_j)$  between  $F_i$  and  $F_j$  is related to  $\langle u_i, u_j \rangle$  as:

$$\langle u_i, u_j \rangle = -\cos \angle (F_i, F_j).$$

<sup>998</sup> The cosine of the dihedral angle satisfies:

$$\cos \angle (F_i, F_j) = \frac{S_{ji}}{S_j},$$

where  $S_j$  is the (n-1)-dimensional volume of face  $F_j$ , and  $S_{ji}$  is the volume of the projection of  $F_j$  onto  $F_i$  along  $u_i$ . For a regular simplex, the volumes  $S_j$  and  $S_{ji}$  are proportional, with:

$$\frac{S_{ji}}{S_j} = \frac{1}{n}.$$

1008 Thus, the matrix D becomes:

D =	$\begin{bmatrix} 1\\ -\frac{1}{n}\\ \vdots\\ -\frac{1}{n} \end{bmatrix}$	$-\frac{1}{n}$ $1$ $\vdots$ $-\frac{1}{n}$	···· ··· ··.	$-\frac{1}{n}$ $-\frac{1}{n}$ $\vdots$ $1$	
D =	$\begin{bmatrix} -\frac{1}{n} \\ \vdots \\ -\frac{1}{n} \end{bmatrix}$	$ \begin{array}{c} 1\\ \vdots\\ -\frac{1}{n} \end{array} $	···· ··. ···	$-\frac{1}{n}$ $\vdots$ 1	

Finally, let:

$$\alpha = \left(\frac{n}{n+1}\langle u_1, x \rangle, \dots, \frac{n}{n+1}\langle u_{n+1}, x \rangle\right)$$

1018 Since  $\alpha$  satisfies the equation system, any point  $x \in \mathbb{R}^n$  can be expressed as:

$$x = \sum_{i=1}^{n+1} \alpha_i u_i.$$

1024 This completes the proof that the John ellipsoid of a regular simplex is its inscribed ball.

1026 Theorem 4 establishes the relationship between integrable functions and unit vectors satisfying specific equality conditions, 1027 providing a bound on the integral product. Theorem 5 extends this by identifying the necessary conditions for equality, 1028 ensuring the unit vectors form an orthonormal basis in  $\mathbb{R}^n$ .

Theorem 3.6 (Brascamp-Lieb inequality). Let  $\{u_i\}_{i=1}^m$  be a sequence of unit vectors in  $\mathbb{R}^n$  and  $\{c_i\}_{i=1}^m$  be a sequence of positive real numbers satisfying:

$$\sum_{i=1}^m c_i u_i \otimes u_i = I_n,$$

where  $I_n$  is the identity matrix. For a sequence of integrable functions  $f_i : \mathbb{R} \to [0, \infty), i = 1, ..., m$ , the following inequality holds:

$$\int_{\mathbb{R}^n} \prod_{i=1}^m f_i(\langle u_i, x \rangle)^{c_i} dx \le \prod_{i=1}^m \left( \int_{\mathbb{R}} f_i(t) dt \right)^{c_i}$$

Theorem 3.7 (Generalization of convolution inequality). Let  $\{u_i\}_{i=1}^m$  and  $\{c_i\}_{i=1}^m$  satisfy the conditions of Theorem 4, and let  $\{f_i\}_{i=1}^m$  be a sequence of functions, nonzero in  $L_1(\mathbb{R})$  and not the density of a Gaussian distribution. The equality in Theorem 4 holds if and only if:

$$m = n$$
, and  $\{u_i\}_{i=1}^m$  forms an orthonormal basis of  $\mathbb{R}^n$ 

1045 **Theorem 3.2.** A simplex C in  $\mathbb{R}^n$  is regular if and only if its John ellipsoid is the unit ball  $B_2^n$ . If  $B_2^n$  is the John ellipsoid of 1046 C, then  $B_2^n$  must be tangent to each face  $F_i$  of C. Conversely, if C is a regular simplex, its John ellipsoid is necessarily  $B_2^n$ , 1047 as the regularity ensures symmetry and equal tangency conditions.

 $\begin{array}{c} 1048\\ 1049 \end{array}$  The volume of C satisfies:

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$$Vol(C) = \frac{\sqrt{n^n(n+1)^{n+1}}}{n!},$$

1052 which is the exact volume of a regular simplex with its inscribed ball being  $B_2^n$ . Furthermore, for the unit normal vectors 1053  $\{v_i\}_{i=1}^{n+1}$  corresponding to the faces of C, the inner product between any two distinct vectors satisfies:

$$\langle v_i, v_j \rangle = -\frac{n+1}{n^2}, \quad i \neq j$$
<sup>(20)</sup>

This establishes that the regularity of a simplex is directly characterized by the tangency, volume, and inner product properties of its John ellipsoid.

1061 *Proof.* To establish that a simplex C in  $\mathbb{R}^n$  is regular if and only if its John ellipsoid is the unit ball  $B_2^n$ , we proceed by 1062 proving both directions.

Assume that  $B_2^n$  is the John ellipsoid of C. By definition,  $B_2^n$  is the largest volume ellipsoid inscribed in C, tangent to each face  $F_i$  of C. Denote the tangent points by  $\{B_i, i = 1, ..., n + 1\}$ . Let  $\{u_i, i = 1, ..., n + 1\}$  be the outer unit normal vectors of the faces of the simplex.

 $\sum_{i=1}^{n+1} c_i u_i \otimes u_i = I_n,$ 

 $\sum_{i=1}^{n+1} c_i u_i = 0,$ 

1067 The barycentric sum must satisfy:

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1075 where  $c_i > 0$  are the weights ensuring that  $B_2^n$  is the John ellipsoid.

1076 Define the set  $K = \{x \in \mathbb{R}^n : (x, u_i) \le 1, i = 1, ..., n + 1\}$ . Since the tangent points  $\{B_i\}$  are on the boundary of C and 1077  $B_2^n$ , we observe that  $K \subseteq C$ . The tangency condition implies that K and C share the same boundary points, hence K = C. 1078 The same boundary points is the same boundary points in the same boundary points.

1070 To confirm that C is regular, consider  $\mathbb{R}^{n+1}$  as  $\mathbb{R}^n \times \mathbb{R}$ . Let the vectors:

$$v_i = \sqrt{\frac{n}{n+1}} \left(-u_i, \frac{1}{\sqrt{n}}\right), \quad i = 1, \dots, n+1,$$

and assign weights:

$$d_i = \frac{n+1}{n}c_i, \quad i = 1, \dots, n+1.$$

1087 The above definitions ensure that:

$$\sum_{i=1}^{n+1} d_i v_i \otimes v_i = I_{n+1}.$$

1091 Define the function sequence  $\{f_i(t)\}$  as:

$$f_i(t) = \begin{cases} e^{-t}, & t \ge 0, \\ 0, & t < 0. \end{cases}$$

1096 For any  $x \in \mathbb{R}^{n+1}$ , let:

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$$F(x) = \prod_{i=1}^{n+1} f_i \left( \langle v_i, x \rangle \right)^{d_i}.$$

1100 By Theorem 4, we have:

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$$\int_{\mathbb{R}^n} F(x) dx \le \prod_{i=1}^{n+1} \left( \int_{\mathbb{R}} f_i(t) dt \right)^{d_i} = 1$$

Following the integration, using results from [Ba2], we calculate:

$$e^{-\sqrt{n+1}r} \mathrm{Vol}(K) \leq e^{-\sqrt{n+1}r} r^n \mathrm{Vol}(K) \implies \mathrm{Vol}(K) \leq \frac{\sqrt{n^n (n+1)^{n+1}}}{n!}.$$

1110 This matches the volume of a regular simplex with its inscribed ball being  $B_2^n$ .

Observe the construction of  $\{f_i\}$  and Theorem 5, which shows that equality holds in the volume bound, and  $\{v_i\}_{i=1}^{n+1}$  forms an orthonormal basis in  $\mathbb{R}^{n+1}$ . For any two vectors of this basis:

$$v_i = \sqrt{\frac{n}{n+1}} \left(-u_i, \frac{1}{\sqrt{n}}\right), \quad v_j = \sqrt{\frac{n}{n+1}} \left(-u_j, \frac{1}{\sqrt{n}}\right),$$

1117 we compute:

$$\langle v_i, v_j \rangle = \frac{n}{n+1} \langle u_i, u_j \rangle + \frac{1}{n+1}$$

1120 For  $i \neq j$ : 1121

$$\langle u_i, u_j \rangle = -\frac{n+1}{n^2}.$$

<sup>1124</sup> Because the vectors  $\{u_i\}_{i=1}^{n+1}$  are normal to the n+1 faces of the simplex K, this confirms that K is a regular simplex.

 $\frac{1125}{1126}$  This completes the proof.

**Theorem 3.3.** A regular simplex can be quantified by how closely it satisfies the conditions of the John ellipsoid. For a given set of group centers  $V = \{v_1, v_2, ..., v_n\}$ , let I denote the identity matrix,  $v_i$  represent individual group centers, and T denote the total number of group centers. Define the regularity measure based on the group centers V as:

$$\phi(V) = \frac{1}{T} \sum_{t=1}^{T} \exp\left(-\frac{\|I - \sum_{i=1}^{n} c_i v_i \otimes v_i\|^2}{2\sigma^2}\right)$$
(21)

where  $\sigma^2 = \frac{1}{2\pi}$  is the variance of the Gaussian function. 1136

1137 Proof. The goal is to establish that the defined regularity measure  $\phi(V)$  quantifies how closely a given set of group centers 1138  $V = \{v_1, v_2, \dots, v_n\}$  satisfies the conditions of a regular simplex, characterized by the John ellipsoid being the unit ball 1139  $B_2^n$ .

A regular simplex aligns with the John ellipsoid if and only if its group centers satisfy specific geometric and algebraic properties. These include symmetry, tangency of the ellipsoid to the simplex faces, and uniform distribution of the group centers. To capture these properties mathematically, the Frobenius norm  $||I - \sum_{i=1}^{n} c_i v_i \otimes v_i||^2$  measures the deviation from the identity matrix *I*, which represents an ideal configuration of the group centers. The function  $\phi(V)$  is then defined as:

$$\phi(V) = \frac{1}{T} \sum_{t=1}^{T} \exp\left(-\frac{\|I - \sum_{i=1}^{n} c_{i} v_{i} \otimes v_{i}\|^{2}}{2\sigma^{2}}\right),$$

1149 where  $c_i > 0$  are weights, and  $\sigma^2 = \frac{1}{2\pi}$  is the variance of the Gaussian function.

To prove that  $\phi(V)$  serves as a valid regularity measure, consider the term  $||I - \sum_{i=1}^{n} c_i v_i \otimes v_i||^2$ . Let  $M = I - \sum_{i=1}^{n} c_i v_i \otimes v_i$ , where M represents the deviation matrix. The Frobenius norm of M is:

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1154 
$$||M||^2 = \operatorname{trace}(M^\top M).$$

1155 Expanding  $M^{\top}M$ , we have:

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$$M^{\top}M = \left(I - \sum_{i=1}^{n} c_i v_i \otimes v_i\right)^{\top} \left(I - \sum_{i=1}^{n} c_i v_i \otimes v_i\right)$$

1160 Simplifying the terms, we obtain: 1161

$$\|M\|^2 = \operatorname{trace}(I^{\top}I) - 2\operatorname{trace}\left(I^{\top}\sum_{i=1}^n c_i v_i \otimes v_i\right) + \operatorname{trace}\left[\left(\sum_{i=1}^n c_i v_i \otimes v_i\right)^{\top}\left(\sum_{j=1}^n c_j v_j \otimes v_j\right)\right]$$

The first term trace  $(I^{\top}I)$  simplifies to *n*, the dimensionality of *I*. The second term evaluates to:

trace 
$$\left(I^{\top}\sum_{i=1}^{n}c_{i}v_{i}\otimes v_{i}\right) = \sum_{i=1}^{n}c_{i}$$

The third term expands as:

trace 
$$\left[\left(\sum_{i=1}^{n} c_i v_i \otimes v_i\right)^{\top} \left(\sum_{j=1}^{n} c_j v_j \otimes v_j\right)\right] = \sum_{i=1}^{n} \sum_{j=1}^{n} c_i c_j \langle v_i, v_j \rangle^2,$$

1177 where  $\langle v_i, v_j \rangle$  denotes the inner product between the group centers  $v_i$  and  $v_j$ .

<sup>1178</sup> Combining these results, we obtain:

$$||M||^{2} = n - 2\sum_{i=1}^{n} c_{i} + \sum_{i=1}^{n} \sum_{j=1}^{n} c_{i}c_{j} \langle v_{i}, v_{j} \rangle^{2}.$$

The Gaussian function  $\exp\left(-\frac{\|M\|^2}{2\sigma^2}\right)$  applies a penalty to configurations with higher deviation  $\|M\|^2$ , emphasizing those closer to the identity matrix. By summing this weighted measure over *T* configurations and normalizing,  $\phi(V)$  provides a robust measure of regularity across multiple simplex configurations.

1188 The term  $\sigma^2 = \frac{1}{2\pi}$  controls the sensitivity of the Gaussian function, ensuring that minor deviations from regularity are not 1189 overly penalized, while significant deviations are sharply discouraged.

Thus,  $\phi(V)$  effectively quantifies the regularity of a simplex by penalizing deviations from the identity matrix. Its formulation ensures that the measure aligns with the geometric and algebraic conditions of the John ellipsoid, completing the proof.

The definition 3.4 establishes the property of logarithmic concavity, ensuring a specific structure of functions where the weighted averages of the inputs produce outputs bounded by a geometric mean.

1196 **Definition 3.4** (Logarithmically Concave Function). A function  $f : \mathbb{R}^n \to \mathbb{R}$  is called logarithmically concave if for any 1197  $x, y \in \mathbb{R}^n$  and  $0 < \lambda < 1$ ,

$$f(\lambda x + (1 - \lambda)y) \ge f(x)^{\lambda} f(y)^{1 - \lambda}$$

1200 The lemma 3.5 provides an inequality for integrals involving logarithmically concave functions, facilitating bounds for 1201 complex integrals in optimization and probabilistic analysis.

<sup>02</sup> Lemma 3.5. Let  $G : \mathbb{R} \to [0, \infty)$  be a logarithmically concave function and k > 0. Then:

$$G(0)^k \int_0^\infty G(x) x^k dx \le \Gamma(k+1) \left( \int_0^\infty G(x) dx \right)^{k+1}.$$

The lemma 3.6 bounds products of weighted integrals of logarithmically concave functions, which is critical for deriving inequalities in functional analysis and probability theory.

10 **Lemma 3.6.** Let f be a positive logarithmically concave function on  $\mathbb{R}$ . Then:

$$\left(\int_0^\infty f(x)e^{-x}dx\right)\left(\int_0^\infty f(x)(1+x)dx\right) \le \left(\int_0^\infty f(x)dx\right)^2.$$

Theorem 3.4. Following (Li et al., 2015; Pearce et al., 2020; de G. Matthews et al., 2018), assume the parameter space follows a Gaussian distribution in  $\mathbb{R}^d$ . The proportion of the parameter space (PS) occupied by the constructed (n-1)-dimensional simplex (S)is:

$$\rho = \frac{Vol(S)}{Vol(PS)} = \frac{\sqrt{n+1}\Gamma\left(\frac{m}{2}+1\right)}{(n-1)!\,l\,\pi^{m/2}\sqrt{2}\sigma^m} \tag{22}$$

where  $\Gamma$  is the Gamma function,  $\sigma$  represents the standard deviation of the Gaussian distribution defining the spread of the parameter space, m is the dimensionality of the Gaussian parameter space, and l is the edge length of the constructed simplex.

1224 *Proof.* To establish the proportion  $\rho$  of the parameter space (PS) occupied by the constructed (n-1)-dimensional simplex, 1225 we calculate the ratio of the simplex volume Vol(S) to the PS volume Vol(PS).

The parameter space corresponds to the high-probability region of a Gaussian distribution in  $\mathbb{R}^d$ , defined by the probability density function:

$$f(x) = \frac{1}{(2\pi\sigma^2)^{m/2}} \exp\left(-\frac{\|x-\mu\|^2}{2\sigma^2}\right)$$
(23)

where *m* is the dimensionality of the Gaussian space,  $\mu$  is the mean, and  $\sigma^2$  is the variance. The PS can be approximated by a ball centered at  $\mu$  with radius *R*, enclosing a specified probability mass *P*. Assuming  $R = \sqrt{2}\sigma$ , the radius corresponds to approximately 95% of the probability mass for a standard Gaussian distribution. The volume of this *m*-dimensional ball is given by:  $\pi^{m/2}B^m$ 

$$\operatorname{Vol}(\operatorname{PS}) = \frac{\pi^{m/2} R^m}{\Gamma\left(\frac{m}{2} + 1\right)}$$
(24)

1238 Substituting  $R = \sqrt{2}\sigma$ , we have:

$$\operatorname{Vol}(\operatorname{PS}) = \frac{\pi^{m/2} (\sqrt{2}\sigma)^m}{\Gamma\left(\frac{m}{2} + 1\right)}$$
(25)

1242 Define functions  $f : \mathbb{R} \to [0, \infty)$  and  $F : \mathbb{R}^{n+1} \to [0, \infty)$  by: 1243

$$f(x) = \begin{cases} e^{-x}, & x \ge 0, \\ 0, & x < 0, \end{cases}$$

 $F(x) = \prod_{j=1}^{n+1} f(x_j),$ 

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1251 where  $x = (x_1, x_2, \dots, x_{n+1}) \in \mathbb{R}^{n+1}$ . Let *H* be a hyperplane with  $\sum_{j=1}^{n+1} a_j = 0$ , where  $\mathbf{a} = (a_1, a_2, \dots, a_{n+1})$ .

<sup>1252</sup> <sub>1253</sub> For a fixed t > 0, F is constant on  $S_t$ , and:

$$\operatorname{Vol}_{n-1}(H \cap S_t) = t^{n-1} \operatorname{Vol}_{n-1}(H \cap S_1)$$

1256 1257 A change of coordinates gives:

$$\int_{H} F \, d\text{Vol}_{H} = \int_{H} \prod_{j=1}^{n+1} f(x_{j}) \, d\text{Vol}_{H} = \int_{0}^{\infty} e^{-s\sqrt{n+1}} \text{Vol}_{n-1}(H \cap S_{s/\sqrt{n+1}}) \, ds,$$

1262 which simplifies to:

$$\int_{H} F \, d\text{Vol}_{H} = (n-1)!(n+1)^{-1/2} \text{Vol}_{n-1}(H \cap S_{1})$$

 Thus:

$$\operatorname{Vol}_{n-1}(H \cap S_1) = \frac{\sqrt{n+1}}{(n-1)!} \int_H F \, d\operatorname{Vol}_H.$$

Next, using the Fourier inversion formula, denote the characteristic function of the random variable Y by  $\Phi_Y$ :

$$\Phi_{\sum_{j=1}^{n+1} a_j X_j}(t) = \prod_{j=1}^{n+1} \Phi_{X_j}(a_j t) = \prod_{j=1}^{n+1} \frac{1}{1 + ia_j t}$$

1274 From the Fourier inversion:

$$G(s) = \frac{1}{2\pi} \int_{-\infty}^{\infty} \prod_{j=1}^{n+1} \frac{1}{1 + ia_j t} e^{ist} dt.$$

1278 Assuming  $a_j \neq 0$  for all j, we simplify to: 

$$\int_{H} F \, d\text{Vol}_{H} = G(0) = \frac{1}{2\pi} \int_{-\infty}^{\infty} \prod_{j=1}^{n+1} \frac{1}{1 + ia_{j}t} \, dt$$

1284 Applying Hölder's inequality, and using  $\sum_{j=1}^{n+1} a_j^2 = 1$ :

$$\int_{H} F \, d\mathrm{Vol}_{H} \leq \frac{1}{2\pi} \prod_{j=1}^{n+1} \left( \int_{-\infty}^{\infty} \frac{1}{(1+ia_{j}t)^{2}} \, dt \right)^{1/2}.$$

1289 The integral evaluates to:

$$\int_{H} F \, d\mathrm{Vol}_{H} \leq$$

<sup>1292</sup> with equality if and only if n - 1 of the  $a_j$  are zero.

1294 Now consider  $|a_j| > \frac{1}{l}$  for some j. Without loss of generality, assume  $a_1 > \frac{1}{l}$ . The convolution of densities (h \* g)(t) is:

$$(h*g)(0) = \int_{-\infty}^{\infty} h(x)g(-x) \, dx.$$

 $\int_0^\infty e^{-y} g(-a_1 y) \, dy \le \frac{1}{a_1} \left( \int_0^\infty g(-a_1 y) \, dy \right)^2.$ 

 $\int_{H} F \, d\mathrm{Vol}_{H} \leq \frac{1}{l}.$ 

 $\frac{1}{l},$ 

<sup>1298</sup> Using Lemma 1.3:

1302 Thus:

Then, the constructed (n-1)-dimensional simplex S, characterized by edge length l, has a volume:

$$Vol(S) = \frac{\sqrt{n+1}}{(n-1)!l}$$
 (26)

310 The proportion of the PS occupied by the simplex is:

$$\rho = \frac{\text{Vol}(S)}{\text{Vol}(\text{PS})} \tag{27}$$

<sup>1314</sup> <sub>1315</sub> Substituting the expressions for Vol(S) and Vol(PS), we get:

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$$\rho = \frac{\frac{\sqrt{n+1}}{(n-1)!} l^{n-1}}{\frac{\pi^{m/2} (\sqrt{2}\sigma)^m}{\Gamma(\frac{m}{2}+1)}}$$
(28)

320 Simplifying, this becomes:

$$\rho = \frac{\sqrt{n+1}\Gamma\left(\frac{m}{2}+1\right)}{(n-1)!\,l\,\pi^{m/2}\sqrt{2}\sigma^m} \tag{29}$$

Here, the term  $\Gamma\left(\frac{m}{2}+1\right)$  arises from the volume formula of the *m*-dimensional Gaussian ball, while  $\sqrt{n+1}$  reflects the geometric property of the constructed simplex. The normalization factor (n-1)! accounts for the simplex dimensionality, and the terms *l* and  $\sigma$  represent the edge length and Gaussian spread, respectively. This relationship explicitly quantifies the proportion of the high-probability Gaussian region occupied by the constructed simplex. Thus, the theorem is proven.  $\Box$ 

**Theorem 3.5.** Let g be a convex function defined over a polytope P, and let  $(x_0, y_0) \in P$  be a reference point. The convex envelope of g at  $(x_0, y_0)$  is the solution to the optimization problem:

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 $Conv_{g,P}(x_0, y_0) = \max c, \quad subject \ to:$   $g(x_i, y_i) - [a(x_i - x_0) + b(y_i - y_0) + c] \ge 0, \quad \forall (x_i, y_i) \in V'(P),$   $\min_{x \in [x_j^1, x_j^2]} [g(x, m_j x + q_j) - a(x - x_0) - b(m_j x + q_j - y_0) - c] \ge 0, \quad \forall e_j \in E'(P),$ 

where  $V'(P) \subseteq V(P)$  and E'(P) denote the subsets of vertices and edges, respectively.

Proof. The proof begins by establishing the constraints necessary for the convex envelope at the reference point  $(x_0, y_0)$ . First, consider the vertices  $(x_i, y_i) \in V'(P)$ , where  $V'(P) \subseteq V(P)$  excludes vertices lying on edges in E'(P). At each vertex, the inequality

$$g(x_i, y_i) - [a(x_i - x_0) + b(y_i - y_0) + c] \ge 0$$

ensures that the affine function defined by a, b, and c underestimates g(x, y). The underestimation at these discrete points guarantees feasibility of the optimization problem with respect to the vertices.

Next, we analyze the constraints along the edges  $e_j \in E'(P)$ , where E'(P) consists of edges along which g(x, y) exhibits strict convexity. Each edge  $e_j$  is parameterized by a linear function:

$$y = m_i x + q_i,$$

where  $m_j$  and  $q_j$  define the slope and intercept of the edge. Along each edge, the strict convexity of g(x, y) implies that the minimum value of the following expression:

$$g(x, m_i x + q_i) - a(x - x_0) - b(m_i x + q_i - y_0) - b(m_i x + q_i$$

occurs either at one of the endpoints  $x_j^1, x_j^2$  of the edge or at a critical point  $s_j(a, b)$  within the interval  $[x_j^1, x_j^2]$ . To enforce the underestimation constraint along the edge, it is required that

$$\min_{i \in [x_j^1, x_j^2]} [g(x, m_j x + q_j) - a(x - x_0) - b(m_j x + q_j - y_0) - c] \ge 0.$$

1360 This constraint can be reformulated by analyzing the unconstrained minimum point  $s_i(a, b)$  of:

x

$$f_{e_i}(x) = g(x, m_j x + q_j) - a(x - x_0) - b(m_j x + q_j - y_0)$$

1363 1364 If  $s_j(a,b)$  lies within the interval  $[x_j^1, x_j^2]$ , the minimum occurs at  $s_j(a,b)$ . Otherwise, the minimum occurs at one of the 1365 endpoints  $x_j^1$  or  $x_j^2$ . Using the strict convexity of g(x, y), the first derivative of  $f_{e_j}$  with respect to x determines the nature of 1366  $s_j(a,b)$ :

$$\frac{\partial}{\partial x}f_{e_j}(x) = g_x(x, m_j x + q_j) + m_j g_y(x, m_j x + q_j) - a - bm_j.$$

The sign of this derivative at the endpoints  $x_j^1$  and  $x_j^2$  allows us to evaluate whether  $s_j(a, b)$  lies inside or outside the interval  $[x_j^1, x_j^2]$ .

Combining the vertex and edge constraints, the convex envelope is expressed as the solution to the following optimization problem:

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 $\operatorname{Conv}_{q,P}(x_0, y_0) = \max c,$ 

1375 subject to:

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$$g(x_i, y_i) - [a(x_i - x_0) + b(y_i - y_0) + c] \ge 0, \quad \forall (x_i, y_i) \in V'(P),$$
  
$$g_i(a, b) + ax_0 + by_0 - bq_i > c, \quad \forall e_i \in E'(P),$$

1379 where  $g_j(a, b)$  is defined as: 1380

$$g_j(a,b) = \begin{cases} f_{e_j}(x_j^1), & \text{if } f'_{e_j}(x_j^1) \ge 0, \\ f_{e_j}(x_j^2), & \text{if } f'_{e_j}(x_j^2) \le 0, \\ f_{e_j}(s_j(a,b)), & \text{otherwise.} \end{cases}$$

where  $h_j(a, b)$  corresponds to the minimum value at the critical point  $s_j(a, b)$ . By the strict convexity of g(x, y),  $s_j(a, b)$ is unique and determined by the derivative  $f'_{e_j}(s_j(a, b)) = a + bm_j$ . The continuity of  $h_j$  and its derivatives depends on  $s_j(a, b)$ , which is given by:

$$\frac{\partial s_j}{\partial a}(a,b) = -s_j(a,b), \quad \frac{\partial s_j}{\partial b}(a,b) = -(m_j s_j(a,b)).$$

1391 Substituting into the derivative of  $h_i$ , we have:

$$\frac{\partial h_j}{\partial a}(a,b) = f'_{e_j}(s_j(a,b))\frac{\partial s_j}{\partial a} - s_j(a,b),$$

and similarly for  $\frac{\partial h_j}{\partial b}(a,b)$ . Since  $f_{e_j}(x)$  is strictly convex, its derivatives are continuous, ensuring the differentiability of  $h_j(a,b)$ .

Finally, the convexity of  $g_j(a, b)$  and the differentiability of its components  $l_j^1, l_j^2, h_j$  ensure that the edge-related constraints are continuously differentiable. Combined with the vertex constraints, this proves that the entire optimization problem is convex with continuously differentiable constraints.

1402 This concludes the proof.

# <sup>1404</sup><sub>1405</sub> **D. Algorithm**

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 Algorithm 1 Generate Poisoned Dataset

1407 **Input:** Target model f, initial parameters  $w_0$  at  $t_0$ , loss function L, number of group centers n 1408 **Output:** Poisoned dataset  $D_u$ 1409 Construct f' as a convex approximation of f1410 Set the number of propeller groups n 1411 Initialize group centers  $V = \{v_1, v_2, \dots, v_n\}$ 1412 while Not Converge do 1413  $V \leftarrow \arg \min_V L_t + L_s$ 1414 end while 1415 for  $v_i \in V$  do 1416 Sample data  $D_i$  from  $\mathcal{N}(v_i, \sigma^2)$ end forreturn  $\bigcup_{i=1}^{v} D_i$ 1417 1418 1419

1420 Based on the methods described in Section 3.2 and Section 3.3, we summarize the stPS to construct the poisoned dataset. 1421 As described in Algorithm 1, the construction of the poisoning dataset begins with the initialization of the group centers, 1422 which serve as the key thrust points. The positions of these group centers are then optimized through convex optimization 1423 to stabilize the thrust directions and ensure precise control of the model's parameters during the unlearning process. A 1424 critical step in this process is the construction of a regular simplex using the optimized group centers, which maximizes the 1425 operational space available for parameter adjustments. This ensures that the model can efficiently and effectively control its 1426 parameters within the desired range. Finally, data is sampled around the group centers based on a predefined distribution to 1427 generate the poisoning dataset, which enables the attacker to exert precise influence on the model during the unlearning 1428 attack phase. 1429

# 1430 E. Attack Settings

1431 To evaluate the performance of DDPA, we use the following unlearning methods to implement the attack: first-order-based, 1432 second-order-based, Unrolling SGD, Amnesiac, and SISA. Following prior studies, the attack budget is set between 5% and 1433 20% of the training dataset. In our experimental setup, the model is pre-trained on the clean training dataset along with 1434 the poisoning dataset generated using our proposed method. The proportion of poisoning samples in the training set is 1435 determined by the attack budget. After pre-training, our attack method is implemented under both targeted and untargeted 1436 attack scenarios. In the targeted scenario, the attacker manipulates the unlearning process to cause the model to misclassify 1437 specific inputs into a target class chosen by the attacker. In the untargeted scenario, the attacker aims to disrupt the model's 1438 predictions, causing it to produce incorrect outputs without a specific target class in mind. These scenarios evaluate the 1439 flexibility and effectiveness of the proposed method in different adversarial settings. 1440

# 1442 F. Experimental Details

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1443 Environment. The experiments were conducted on a compute server running on Red Hat Enterprise Linux 7.2 with 2 1444 CPUs of Intel Xeon E5-2650 v4 (at 2.66 GHz) and 8 GPUs of NVIDIA GeForce GTX 2080 Ti (with 11 GB of GDDR6 1445 on a 352-bit memory bus and memory bandwidth in the neighborhood of 620GB/s) and 4 GPUs of NVIDIA H100 (each 1446 with 80GB of HBM2e memory on a 5120-bit memory bus, offering a memory bandwidth of approximately 3TB/s),256GB 1447 of RAM, and 1TB of HDD. Overall, the experiments took about 10 days in a shared resource setting. We expect that a 1448 consumer-grade single-GPU machine could complete the full set of experiments in around 21-23 days, if its full resources 1449 were dedicated. The codes were implemented in Python 3.7.10 and PyTorch 1.9.0. Since the datasets used are all public 1450 datasets and our methodologies and the hyperparameter settings are explicitly described in section 4 and F, our codes and 1451 experiments can be easily reproduced on top of a GPU server. 1452

1453 Training. We conduct experiments on three standard datasets: CIFAR-100, Tiny ImageNet, and SST-2, covering image and 1454 sentiment classification tasks. The datasets are publicly available and are widely used for non-commercial research and 1455 educational purposes. For CIFAR-100, we use 50,000 examples for training and 10,000 examples for testing, training a 1456 VGG16 model for image classification over 150 epochs. On Tiny ImageNet, we use 100,000 examples for training and 1457 10,000 examples for testing, training a ResNet-18 model for image classification over 150 epochs. For SST-2, we use 20,000 1458 examples for training and 872 examples for testing, fine-tuning a LLaMA-3B model with LoRA for sentiment classification 1459 over 10 epochs. All neural networks are trained using SGD optimization, starting with an initial learning rate of 0.1 and a 1460 batch size of 64. Each experiment is repeated three times to ensure stable and reliable results. 1461

Implementation. For 9 state-of-art machine unlearning attack methods of AwoP[],MUECPA[],SSCSF[],BAU[],UBA-1462 Inf[], RMBMU[], DABF[], AdvUA[], EVMUS[], we utilized the same model architecture as the official open-source 1463 implementation and default parameter settings provided by the original authors in all experiments. All hyperparameters are 1464 standard values from reference codes or prior works. We validate the performance of different attack methods with a rang of 1465 unlearing ratio  $\in \{5\%, 10\%, 20\%\}$ , which are commonly used in related studies. For the image datasets, CIFAR-100 and 1466 Tiny ImageNet, all models were trained for 150 epochs using a batch size of 128 and a learning rate of 0.1. For the sentiment 1467 dataset SST-2, all models were trained for 50 epochs with a batch size of 8 and a learning rate of 4e-4. These training 1468 settings were chosen to align with best practices in the literature and ensure consistent comparisons across the experiments. 1469 The above open-source codes from the GitHub are licensed under the MIT License, which only requires preservation of 1470 copyright and license notices and includes the permissions of commercial use, modification, distribution, and private use. 1471

For our DDPA method, we performed hyperparameter selection by performing a parameter unlearning ratio  $1473 \in \{5\%, 10\%, 20\%\}$ , Group center  $V \in \{5, 10, 15, 20, 25\}$ , unlearning rate  $\in \{1e^{-3}, 4e^{-3}, 1e^{-4}, 4e^{-4}, 1e^{-5}\}$ . For the image datasets, CIFAR-100 and Tiny ImageNet, training epoch $\in \{30, 60, 90, 120, 150\}$ , learning rate  $\in \{0.001, 0.005, 0.01, 0.05, 0.1\}$ . We select the bets parameters over 100 epochs of training and evaluate the model at test time. For the sentiment dataset SST-2, training epoch $\in \{10, 25, 50, 100\}$ , learning rate  $\in \{1e^{-4}, 3e^{-4}, 4e^{-4}, 5e^{-5}\}$ . We select the bets parameters over 50 epochs of training and evaluate the model at test time.

Hyperparameter settings. Unless otherwise explicitly stated, we used the following default parameter settings in the
 experiments. As shown in Table 2

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1485	Parameter	Value
1486	Training data on SST-2	20,000
1487	Test data ratio on SST-2	872
1488	Training data on CIFRA100	5,000
1489	Test data on CIFRA100	1,000
1490	Training data on Tiny-ImageNet	100,000
491	Test data on Tiny-ImageNet	10,000
492	Group Center V	5
493	Training epochs of the DDPA on image dataset	150
494	Training epochs of the DDPA on sentiment dataset	50
495	Batch size for training the model on image dataset	128
496	Batch size for training the model on sentiment dataset	8
497	Learning rate on image dataset	0.1
1498	Learning rate on sentiment dataset	1e-4

Table 2. Model parameters and settings

#### F.1. Additionl Experiments

Attack performance on various dataset with different unlearning algorithms. Table 3 - 19 presents the TA, BA and ASR scores of five machine unlearning algorithms evaluated on test data arcoss 12 attack models. For each attack model ,we reserve 5%, 10% and 20% of the training dataset as the attack dataset. The conceal setting represents the evaluation before the unlearning attack, while unlearn refers to the results after the attack is applied. For targeted attacks, we observe that across all 12 attack methods, DDPA maintains an ASR of 0 before unlearning, while achieving relatively high test accuracy in most cases. This indicates that the poisoning dataset constructed by DDPA is highly stealthy. After the unlearning attack, DDPA achieves the highest ASR and the lowest BA, demonstrating its effectiveness in executing a successful attack. Compared to other attack models across the five machine unlearning algorithms, DDPA achieves an average ASR increase of 22.74%, 16.07%, and 21.45%, while reducing BA by 15.76%, 11.41%, and 2.27% on VGG16-CIFAR100, ResNet18-Tiny-ImageNet, and LLaMA-3B-SST-2 respectively. In addition, the promising performance of DDPA with all machine unlearning algorithms implies that DDPA has greate potential as a general attack solution to other machine unlearning methods, which is desirable in practice.

	Table 5. C	Jniear	ining P	eriori	nance So	on v	10-10 dor	with	CIFAR	<u>n (</u>	10%	mnocic	neu)-t	argete	U STEA	
Method	B/A Unlearn		DA	ACD	TA	DA	ACD		DA	<u> 4 CD</u>	TA	DA		TA	DA	10
	Canacal	1A 08.10	DA 40.20	ASK 22.10	1A 09.22	DA 40.52	A3K	1A 09.46	DA 49.72	A5K	1A	DA 40.25	ASK 27.70	1A 08.07	DA 40.00	22
AwoP	Unloarn	96.10	49.30	23.10	96.55	49.52	24.05	96.40	46.72	S1.00	96.60	49.23	27.70	90.97	49.09	23.
	Concool	90.09	45.25	2.00	90.39	44.72	0.00	90.70	45.52	0.00	90.74	43.70	0.20	97.50	40.18	00.
MUECPA	Unloarn	98.10	40.22	2.00	98.20	49.54	0.00	97.04	47.42	0.00	92.97	47.20	0.20 85.20	96.40	47.10	Q.2
	Concool	97.71	44.99	0.00	97.23	43.08	0.00	02.19	44.42	0.00	09.59	43.36	0.00	90.05	45.50	04.
SSCSF	Unlearn	99.40	49.50	80.30	96.12	48.04	88 73	96.52	46.50	85.00	96.50	49.13	89.60	96.00	47.20	88
	Conceal	98.36	46 47	0.00	98.36	46.47	0.00	98 78	47.36	0.00	98.31	47 70	0.00	98 24	47.46	0.0
BAU	Unlearn	95.82	43.40	86.90	96.02	43 32	87.40	95.92	45.67	88.00	96.14	44.93	88 40	96 74	45.06	89
	Conceal	98.26	50 74	9 20	98.04	49.30	7 60	98.86	50.21	16.28	98 77	49.72	12.46	98.05	49.93	13
UBA-Inf	Unlearn	96.71	44.83	87.60	96.73	44.05	90.00	96.04	45.13	89.40	96.36	45.06	90.00	96.93	43.99	86.
	Conceal	98.94	47.04	5.20	98.73	47.40	1.60	98.68	47.53	0.00	98.33	48.89	0.00	98.16	48.69	0.0
RMBMU	Unlearn	96.00	44.94	87.60	97.42	44.44	89.40	97.02	44.38	88.40	97.55	45.36	88.40	96.98	45.18	87.
	Conceal	98.26	48.04	0.34	98.54	48.26	1.24	98.78	48.15	0.82	98.67	48.88	0.70	98.35	48.94	2.4
DABF	Unlearn	96.28	43.62	85.30	96.09	44.73	86.20	96.02	44.29	89.00	96.63	43.94	89.20	96.75	45.06	88.
	Conceal	98.47	47.53	0.00	98.57	47.40	0.00	98.46	48.80	0.00	98.77	48.80	0.00	98.54	48.65	0.0
AdvUA	Unlearn	95.75	43.60	88.30	96.20	44.60	87.60	96.31	45.72	87.60	96.79	45.03	89.60	96.40	45.54	89.
EVALUE	Conceal	99.45	50.36	2.90	99.94	49.09	0.76	98.85	49.61	1.64	98.83	49.52	0.80	99.26	48.62	1.2
EVMUS	Unlearn	96.64	45.58	84.90	96.30	44.45	86.00	96.82	45.76	86.40	96.75	44.87	88.00	97.09	45.75	88.
DDDA	Conceal	98.75	47.86	0.00	98.94	48.61	0.00	98.65	48.99	0.00	98.61	48.11	0.00	98.66	48.56	0.0
DDPA	Unlearn	95.81	43.18	90.00	95.93	43.23	90.60	94.48	43.32	92.00	95.87	43.07	91.00	95.09	44.24	90.
DDDA C	Conceal	98.01	46.32	0.00	98.29	47.82	0.00	98.11	47.28	0.00	98.16	48.11	0.00	98.19	48.48	0.0
DDPA-C	Unlearn	95.35	44.04	82.10	95.21	44.77	80.20	94.43	44.17	81.80	95.35	44.61	81.20	95.23	45.51	80.
DDDA S	Conceal	98.04	46.39	0.00	98.43	47.01	0.00	98.17	47.58	0.00	98.79	47.91	0.00	98.45	47.79	0.0
DDPA-3	Unlearn	95.18	44.53	83.00	95.30	45.43	81.50	93.95	44.55	82.00	96.11	44.24	83.40	95.60	45.53	83.

								10-10	with		(100 (.	20% C	Jinean	neu)-u	<u>urgette</u>			
	Method	B/A Unlearn	TA Fi	rst-Ord	A SR	Sec TA	ond-Or	der ASR		nroll-S(	GD ASR		Amnesia RA		ТΔ	SISA BA	ASR	
		Conceal	98.91	49.12	19.64	98.20	49.25	26.39	98.96	48.68	24.74	98.70	48.65	23.10	98.98	49.11	0.00	
	AwoP	Unlearn	96.32	43.28	90.20	96.65	43.73	90.00	97.03	43.11	92.10	96.97	42.98	90.00	96.63	44.70	90.40	
	MUECPA	Conceal	96.73	52.79	0.00	98.18	48.39	1.00	98.84	47.92	0.40	96.96	41.59	0.60	98.45	47.52	1.20	
		Conceal	90.25 98.42	48.74	90.00	97.08 98.56	42.69 48.87	93.80	95.50 98.86	44.70 48.48	92.68	87.33 98.54	37.52	88.00	94.21 98.62	42.69 48.37	91.60	
	SSCSF	Unlearn	97.50	43.27	91.00	96.27	42.87	90.60	96.98	42.37	91.60	96.28	42.13	90.00	96.12	42.79	91.20	
	BAU	Conceal	98.46	47.79	0.00	98.14	48.22	0.00	98.14	48.33	0.00	98.47	48.40	0.00	97.82	48.86	0.00	
		Unlearn	96.78	43.26	89.00	96.19	42.44	90.00	95.78	42.79	90.20	96.65	42.38	89.60	95.14	43.73	90.40	
	UBA-Inf	Unlearn	99.34 97.30	30.33 44.82	92.60	98.85 97.41	49.72	9.82 91.40	96.55	44.35	91.20	99.09 96.70	49.41	91.00	98.22 92.47	30.87 41.89	92.34	
	DMDMI	Conceal	98.20	48.61	7.00	98.01	48.18	0.20	98.09	49.47	2.60	98.88	48.23	0.60	98.57	48.75	3.40	
	RMBMO	Unlearn	97.97	42.51	81.40	96.91	43.68	87.40	96.33	42.75	86.00	96.34	43.33	85.00	95.65	42.82	89.00	
	DABF	Unlearn	98.26 96.30	48.23	0.00 90.00	98.93 97.05	48.90 43.79	0.00 91.20	98.45 96.27	48.85	0.00 91.00	98.29 96.33	48.36	0.00	97.92	48.10	0.00	
	A J. J.	Conceal	98.84	48.42	0.00	98.19	48.37	0.00	98.70	48.55	0.00	98.54	48.67	0.00	98.41	48.33	0.00	
	AUVUA	Unlearn	96.63	43.36	90.60	95.62	42.78	91.00	95.93	43.64	90.20	94.92	42.46	91.20	95.90	43.76	90.00	
	EVMUS	Conceal	99.24	50.13	1.92	98.85 06.64	49.36	0.27	99.31	49.82	2.50	98.89	49.61	1.94	98.86	49.88	1.11	
		Conceal	98.95	48,81	0.00	98.93	43.90 48,61	0.00	90.55 98.48	44.25 48.99	90.00 0.00	90.55 98.61	48.37	91.20 0.00	98.93	48,56	91.00	
	DDPA	Unlearn	95.49	42.18	96.00	95.07	42.23	95.00	95.11	42.01	94.00	95.87	41.07	95.60	95.09	42.02	94.80	
	DDPA-C	Conceal	98.24	47.10	0.00	98.31	47.85	0.00	98.07	48.03	0.00	98.37	48.11	0.00	98.29	47.50	0.00	
		Unlearn Conceal	95.59 98 33	43.53 48.28	88.00 0.00	94.99 98.63	43.68 47.13	89.20 0.00	95.26 98 10	43.10 48.45	89.20 0.00	95.62 98 54	42.48 47 47	90.00 0.00	95.56 98.04	43.30 47 51	89.90 0.00	
	DDPA-S	Unlearn	95.03	43.20	90.00	95.34	43.29	90.20	95.04	44.43	90.10	95.27	42.50	91.20	95.16	43.41	91.70	
		Table 5 11-	learniz	ng Dow	forme	nce or	BacN	[et 10	with 7	Finy I-	nagoN	[et (50	Z I Inla	amad		stad		
		<u>Table 5. Un</u>	learnir Fi	ng Peri	formai	nce on Sec	ResN	let-18	with ] Ui	finy Ir. nroll-SC	nageN	let (5%	6 Unle	earned	)-targe	eted SISA		
	Method	<u>Table 5. Un</u> B/A Unlearn	learnir Fi TA	ng Peri rst-Ord BA	formai ler ASR	nce on Sec TA	ResN ond-Or BA	et-18 der ASR	with 7	Гіпу Іп nroll-S( ВА	nageN 3 <b>D</b> ASR	<u>fet (5%</u> <u>A</u> TA	6 Unle Amnesia BA	arned	)-targe	eted SISA BA	ASR	
	Method	Table 5. Un B/A Unlearn	learnir Fi TA 98.97	ng Pert rst-Ord BA 42.15	formati ler 21.23	nce on <u>Sec</u> TA 98.58 07.05	ResN ond-Or BA 41.69	et-18 der ASR 16.43	with $\frac{1}{U_1}$ TA 98.51	Finy In nroll-SC BA 41.10	nageN 3D ASR 17.82	$\frac{\text{[et (5\%]]}}{TA}$ 98.74	6 Unle Mnnesia BA 42.04	arned arned ASR 23.21 \$1.20	)-targe TA 98.88 96.70	eted <b>SISA</b> BA 42.59 26.27	ASR 21.49	
	<b>Method</b> AwoP	Table 5. Un B/A Unlearn Conceal Unlearn Conceal	learnir TA 98.97 96.64 98.76	ng Pert rst-Ord BA 42.15 36.73 42.78	format ler 21.23 80.00 0.00	nce on Sec TA 98.58 97.05 98.03	ResN ond-Or BA 41.69 37.30 43.30	et-18 der ASR 16.43 80.40 0.00	with 7 U1 TA 98.51 96.14 98.14	Γiny In nroll-SC BA 41.10 36.90 42.69	nageN 5D ASR 17.82 80.00 0.00	et (5%) A 78.74 96.33 97.98	6 Unle mnesiz BA 42.04 36.71 42.30	arned ac ASR 23.21 81.20 0.00	)-targe TA 98.88 96.79 97 21	eted <b>SISA</b> 42.59 36.27 43.15	ASR 21.49 81.52 0.00	
	Method AwoP MUECPA	Table 5. Un B/A Unlearn Conceal Unlearn Conceal Unlearn	learnir Fi TA 98.97 96.64 98.76 96.48	ng Pert rst-Ord BA 42.15 36.73 42.78 36.49	formati ler 21.23 80.00 0.00 81.00	nce on TA 98.58 97.05 98.03 96.46	ResN ond-Or BA 41.69 37.30 43.39 37.42	et-18 der ASR 16.43 80.40 0.00 82.60	with 7 Un 7A 98.51 96.14 98.14 96.95	Finy In <b>nroll-SC</b> BA 41.10 36.90 42.69 36.63	nageN 3D ASR 17.82 80.00 0.00 85.20	et (5%) <u>A</u> 98.74 96.33 97.98 95.98	6 Unle mnesia BA 42.04 36.71 42.39 36.53	arned ac ASR 23.21 81.20 0.00 84.00	)-targe TA 98.88 96.79 97.21 94.91	eted <b>SISA</b> 42.59 36.27 43.15 36.13	ASR 21.49 81.52 0.00 84.00	
	Method AwoP MUECPA	Table 5. Un B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal	learnir TA 98.97 96.64 98.76 96.48 99.76	ng Perf rst-Ord BA 42.15 36.73 42.78 36.49 41.42	format ler 21.23 80.00 0.00 81.00 0.00	nce on <u>Sec</u> <u>TA</u> 98.58 97.05 98.03 96.46 99.76	ResN ond-Or BA 41.69 37.30 43.39 37.42 41.73	et-18 der ASR 16.43 80.40 0.00 82.60 0.00	with 7 U1 TA 98.51 96.14 98.14 96.95 99.78	Finy In nroll-SC BA 41.10 36.90 42.69 36.63 41.67	nageN 3D ASR 17.82 80.00 0.00 85.20 0.00	et (5%) TA 98.74 96.33 97.98 95.98 99.58	6 Unle mnesia BA 42.04 36.71 42.39 36.53 41.38	arned ac ASR 23.21 81.20 0.00 84.00 0.00	)-targe TA 98.88 96.79 97.21 94.91 98.75	sted <b>SISA</b> 42.59 36.27 43.15 36.13 41.80	ASR 21.49 81.52 0.00 84.00 0.00	
	Method AwoP MUECPA SSCSF	Table 5. Un B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	learnin TA 98.97 96.64 98.76 96.48 99.76 97.72 90.02	<b>ig Peri</b> <b>rst-Ord</b> <b>BA</b> 42.15 36.73 42.78 36.49 41.42 35.75 40.75	formati ler 21.23 80.00 0.00 81.00 0.00 80.00	nce on TA 98.58 97.05 98.03 96.46 99.76 97.73 90.02	ResN ond-Or BA 41.69 37.30 43.39 37.42 41.73 36.07	et-18 der ASR 16.43 80.40 0.00 82.60 0.00 82.40 0.00	with T U1 TA 98.51 96.14 98.14 96.95 99.78 97.46 97.46	Ciny In           nroll-SC           BA           41.10           36.63           41.67           35.82           40.67	nageN 3D ASR 17.82 80.00 0.00 85.20 0.00 86.00	et (5%) TA 98.74 96.33 97.98 95.98 99.58 96.17	6 Unle mnesiz BA 42.04 36.71 42.39 36.53 41.38 35.43	arned ac ASR 23.21 81.20 0.00 84.00 0.00 84.20	)-targe TA 98.88 96.79 97.21 94.91 98.75 96.22	ted <b>SISA</b> 42.59 36.27 43.15 36.13 41.80 35.51 41.22	ASR 21.49 81.52 0.00 84.00 0.00 86.26 0.00	
	Method AwoP MUECPA SSCSF BAU	Table 5. Un B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	learnin Fi TA 98.97 96.64 98.76 96.48 99.76 97.72 98.98 95.72	<b>ig Peri</b> <b>rst-Ord</b> <b>BA</b> 42.15 36.73 42.78 36.49 41.42 35.75 40.73 33.75	formal ler 21.23 80.00 0.00 81.00 0.00 80.00 80.00	nce on TA 98.58 97.05 98.03 96.46 99.76 99.76 99.73 99.95 96.30	ResN ond-Or BA 37.30 43.39 37.42 41.73 36.07 41.42 35.07	et-18 der ASR 16.43 80.40 0.00 82.60 0.00 82.40 0.00 83.20	with 7 U1 TA 98.51 96.14 98.14 96.95 99.78 97.46 98.83 95.46	Finy In nroll-S( BA 41.10 36.90 42.69 36.63 41.67 35.82 40.67 35.82 40.67 34.82	nageN 3D ASR 17.82 80.00 0.00 85.20 0.00 86.00 0.00 86.02	[et (5%) A 98.74 96.33 97.98 95.98 99.58 96.17 99.58 96.17	6 Unle mnesiz BA 42.09 36.53 41.38 35.43 41.32 34.42	arned ac ASR 23.21 81.20 0.00 84.00 0.00 84.20 0.00 84.20 0.00	)-targe 78.88 96.79 97.21 94.91 98.75 96.22 98.75 96.22 98.75	eted <b>SISA</b> 42.59 36.27 43.15 36.13 41.80 35.51 41.82 34.51	ASR 21.49 81.52 0.00 84.00 0.00 86.26 0.00 85.20	
	Method AwoP MUECPA SSCSF BAU	Table 5. Un B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal	learnin TA 98.97 96.64 98.76 96.48 99.76 97.72 98.98 95.72 98.98	Ig Peri rst-Ord BA 42.15 36.73 36.49 41.42 35.75 40.73 33.75 41.09	formati ler 21.23 80.00 0.00 81.00 0.00 80.00 0.00 80.00 13.67	nce on TA 98.58 97.05 98.03 96.46 99.76 97.79 99.95 96.39 98.53	ResN ond-Or BA 41.69 37.30 43.39 37.42 41.73 36.07 41.42 35.07 40.33	et-18 der ASR 16.43 80.40 0.00 82.60 0.00 82.40 0.00 83.20 11.34	with 7 U1 7A 98.51 96.14 98.14 96.95 99.78 97.46 98.83 95.46 98.79	Finy In nroll-SC BA 41.10 36.90 42.69 36.63 41.67 35.82 40.67 34.82 41.68	nageN 3D ASR 17.82 80.00 0.00 85.20 0.00 85.20 0.00 86.00 0.00 86.93 10.24	let (5% <u>A</u> 98.74 96.33 97.98 95.98 99.58 96.17 99.58 96.17 99.58 96.17 98.64	6 Unle mnesiz BA 42.04 36.71 42.39 36.53 41.38 35.43 41.32 34.33 41.38	arned ac ASR 23.21 81.20 0.00 84.00 0.00 84.20 0.00 83.40 0.00 83.40 0.11.63	)-targe TA 98.88 96.79 97.21 94.91 98.75 96.22 98.75 96.22 98.75 96.22 98.49	eted <b>SISA</b> <b>BA</b> 42.59 36.27 43.15 36.13 41.80 35.51 41.32 34.51 41.32	ASR 21.49 81.52 0.00 84.00 0.00 86.26 0.00 85.20 10.26	
	Method AwoP MUECPA SSCSF BAU UBA-Inf	Table 5. Un B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	learnin TA 98.97 96.64 98.76 99.76 97.72 98.98 95.72 98.98 95.72 98.96 97.16	ng Peri rst-Ord BA 42.15 36.73 42.78 36.49 41.42 35.75 40.73 33.75 41.09 37.33	format er 21.23 80.00 0.00 81.00 0.00 80.00 80.00 13.67 81.00	nce on TA 98.58 97.05 98.03 96.46 97.39 99.95 96.39 99.95 96.39 98.53 97.29	ResN ond-Or BA 41.69 37.30 43.39 37.42 41.73 36.07 41.42 35.07 40.33 37.59	et-18 der ASR 16.43 80.40 0.00 82.60 0.00 82.40 0.00 83.20 11.34 83.91	with T TA 98.51 96.14 98.14 96.95 99.78 97.46 98.83 95.46 98.83 95.46 98.79 96.14	Finy In nroll-SC BA 41.10 36.90 42.69 36.63 41.67 35.82 40.67 34.82 41.68 36.91	nageN 3D ASR 17.82 80.00 0.00 85.20 0.00 86.00 0.00 86.93 10.24 82.13	et (5%) 7A 98.74 96.33 97.98 95.98 96.17 99.58 96.17 99.58 96.17 98.64	6 Unle mnesia BA 36.71 42.04 36.71 42.39 36.53 41.38 35.43 41.38 34.33 41.38 34.33 34.33 34.38 35.43 34.38 35.43 34.38 35.43 34.38 35.43 35.43 34.38 35.43 35.90 35.43 35.90 35.43 35.90 35.43 35.90 35.	earned IC ASR 23.21 81.20 0.00 84.00 0.00 84.20 0.00 83.40 11.63 81.20 0.00 83.40 11.63 81.20 0.00 83.40 11.63 81.20 0.00 83.40 0.00 0.00 83.40 0.00	)-targe TA 98.88 96.79 97.21 94.91 98.75 96.22 98.75 96.22 98.79 97.15	ted <b>SISA</b> <b>BA</b> 42.59 36.27 43.15 36.13 41.80 35.51 41.30 34.51 41.30 38.64	ASR 21.49 81.52 0.00 84.00 0.00 86.26 0.00 85.20 10.26 81.27	
	Method AwoP MUECPA SSCSF BAU UBA-Inf RMBMU	Table 5. Un B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	learnin TA 98.97 96.64 98.76 96.48 99.76 97.72 98.98 95.72 98.98 95.72 98.96 97.16 97.64	ng Peril rst-Ord BA 42.15 36.73 42.78 36.49 41.42 35.75 40.73 33.75 41.09 37.33 40.73 20.21	format er 21.23 80.00 0.00 81.00 0.00 80.00 13.67 81.00 0.00	nce on <b>Sec</b> TA 98.58 97.05 98.03 96.46 97.39 99.95 96.39 98.53 97.29 98.02 95.02	ResN ond-Or BA 41.69 37.30 43.39 37.42 41.73 36.07 41.42 35.07 40.33 37.59 40.14 24.57	et-18 der ASR 16.43 80.40 0.00 82.60 0.00 82.40 0.00 83.20 11.34 83.91 0.00	with T TA 98.51 96.14 98.14 96.95 99.78 97.46 98.83 95.46 98.83 95.46 98.79 96.14 97.69	Finy In nroll-SC BA 41.10 36.90 42.69 36.63 41.67 35.82 40.67 34.82 41.68 36.91 41.83 20.16	nageN 3D ASR 17.82 80.00 0.00 85.20 0.00 86.00 0.00 86.93 10.24 82.13 0.00	et (5%) TA 98.74 96.33 97.98 95.98 96.17 99.58 96.17 99.58 96.17 99.58 96.17 99.58 96.17	6 Unle mnesia BA 42.04 36.71 42.39 36.53 41.38 35.43 41.38 34.43 41.38 36.90 40.89 20.02	earned IC ASR 23.21 81.20 0.00 84.00 0.00 84.20 0.00 84.20 0.00 83.40 11.63 81.00 0.00 0.00	)-targe TA 98.88 96.79 97.21 94.91 98.75 96.22 98.75 96.22 98.75 96.22 98.75 96.72 98.75 96.22 98.75 96.79	eted <b>SISA</b> <b>BA</b> 42.59 36.27 43.15 36.13 41.80 35.51 41.30 34.51 41.30 38.64 47.20 22.22	ASR 21.49 81.52 0.00 84.00 0.00 86.26 0.00 85.20 10.26 81.27 0.00	
	Method AwoP MUECPA SSCSF BAU UBA-Inf RMBMU	Table 5. Un B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	learnin TA 98.97 96.64 98.76 96.64 99.76 97.72 98.98 95.72 98.98 95.72 98.96 97.16 97.64 95.28 98.98	ng Perli rst-Ord BA 42.15 36.73 42.78 36.49 41.42 35.75 40.73 33.75 41.09 37.33 40.73 33.24 41.62	format er ASR 21.23 80.00 0.00 81.00 0.00 80.00 13.67 81.00 0.00 80.00 80.00 0.00 8	nce on TA 98.58 97.05 98.03 96.46 99.739 99.95 96.39 98.02 98.02 95.38 97.29	ResN ond-Or BA 41.69 37.30 43.39 37.42 41.73 36.07 41.42 35.07 40.33 37.59 40.14 34.67 40.22	et-18 der ASR 16.43 80.40 0.00 82.60 0.00 82.60 0.00 83.20 11.34 83.91 0.00 84.30 0.01 2	with 7 TA 98.51 96.14 98.14 96.95 99.78 97.46 98.83 95.46 98.79 96.14 97.69 95.76 98.20 95.76 98.20 95.76	Finy In <b>nroll-SC</b> <b>BA</b> 41.10 36.90 42.69 36.63 41.67 35.82 40.67 34.82 41.68 36.91 41.83 33.40 41.97	nageN 3D ASR 17.82 80.00 0.00 85.20 0.00 86.00 0.00 86.93 10.24 82.13 0.00 84.38 1.54	et (5%) TA 98.74 96.33 97.98 95.98 96.17 99.58 96.17 99.58 96.17 99.58 96.17 99.58 96.17 99.58 96.10 99.58	6 Unle mnesia BA 42.04 36.71 42.39 36.53 41.38 35.43 41.38 34.43 41.38 36.90 40.89 32.89 32.89 32.04	earned IC ASR 23.21 81.20 0.00 84.00 0.00 84.20 0.00 84.20 0.00 83.40 11.63 81.00 0.00 83.40 11.63 81.00 0.00	)-targe TA 98.88 96.79 97.21 94.91 98.75 96.22 98.75 96.22 98.75 96.22 98.49 97.15 98.15 95.92 98.24	eted <b>SISA</b> <b>BA</b> 42.59 36.27 43.15 36.13 41.80 35.51 41.30 34.51 41.30 38.64 47.20 33.25 41.14	ASR 21.49 81.52 0.00 84.00 0.00 86.26 81.27 0.00 85.20 10.26 81.27 0.00 86.74 0.79	
	Method AwoP MUECPA SSCSF BAU UBA-Inf RMBMU DABF	Table 5. Un B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	learnin TA 98.97 96.64 98.76 96.64 99.76 97.72 98.98 97.72 98.98 97.72 98.96 97.16 97.64 95.28 98.32 96.64	ng Perl rst-Ord BA 42.15 36.73 42.78 36.49 41.42 35.75 40.73 33.75 41.09 37.33 40.73 33.24 41.63 35.69	formati ler 21.23 80.00 0.00 80.00 0.00 80.00 13.67 81.00 0.00 80.20 0.43 82.00	nce on TA 98.58 97.05 98.03 96.46 97.39 99.95 96.39 98.53 97.29 98.02 95.38 98.18 95.78	ResN ond-Or BA 41.69 37.30 43.39 37.42 41.73 36.07 40.33 37.59 40.14 34.67 42.02 36.08	et-18 der ASR 16.43 80.40 0.00 82.60 0.00 82.40 0.00 83.20 11.34 83.91 0.00 84.30 0.13 81.21	with 7 TA 98.51 96.14 98.14 96.95 99.78 97.46 98.83 95.46 98.83 95.46 98.79 96.14 97.69 95.76 98.39 95.76 98.39 95.46 98.79 95.76 98.39 97.24	Finy In <b>nroll-SC</b> <b>BA</b> 41.10 36.90 42.69 36.63 41.67 35.82 40.67 34.82 41.68 36.91 41.83 33.40 41.97 35.48	nageN 3D ASR 17.82 80.00 0.00 85.20 0.00 86.93 10.24 82.13 0.00 84.38 1.54 85.00	et (5%) TA 98.74 96.33 97.98 95.98 96.17 99.58 96.17 98.64 96.59 97.62 96.02 98.88 95.81	6 Unle mnesia BA 42.04 36.71 42.39 36.53 41.38 35.43 41.38 35.43 41.38 36.90 40.89 32.89 42.04 34.94	Earned ASR 23.21 81.20 0.00 84.00 0.00 84.20 0.00 83.40 11.63 81.00 0.00 83.40 11.63 81.00 0.00 83.40 11.63 81.00 0.00 83.40 11.63 81.20 0.00 83.40 11.63 81.20 0.00 83.40 11.63 81.20 0.00 83.40 11.63 81.20 0.00 83.40 11.63 81.20 0.00 83.40 11.63 81.20 0.00 83.40 11.63 81.20 0.00 83.40 11.63 81.20 0.00 83.40 11.63 81.20 0.00 83.40 11.63 81.20 0.00 83.40 11.63 81.00 0.00 83.40 11.63 81.00 0.00 83.40 11.63 81.00 0.00 85.00 85.00 0.00 0.00 85.00 0.00 85.00 0.00 85.00 0.00 85.00 0.00 85.00 0.00 85.00 0.00 85.00 0.00 85.00 0.00 85.00 0.00 0.00 85.00 0.00	)-targee TA 98.88 96.79 97.21 94.91 98.75 96.22 98.75 96.22 98.49 97.15 96.22 98.15 95.92 98.34 96.04	eted <b>SISA</b> <b>BA</b> 42.59 36.27 43.15 36.13 41.80 35.51 41.30 34.51 41.30 38.64 47.20 33.25 41.14 34.64	ASR 21.49 81.52 0.00 84.00 0.00 86.26 0.00 85.20 10.26 81.27 0.00 86.74 0.78 84.45	
_	Method AwoP MUECPA SSCSF BAU UBA-Inf RMBMU DABF	Table 5. Un B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	learnin TA 98.97 96.64 98.76 96.64 99.76 97.72 98.98 95.72 98.96 97.16 97.64 95.28 98.32 96.64 98.86	ng Perti rst-Ord BA 42.15 36.73 42.78 36.73 41.42 35.75 40.73 33.75 41.09 37.33 40.73 33.24 41.63 35.69 41.37	formati ler 21.23 80.00 0.00 81.00 0.00 80.00 0.00 80.00 13.67 81.00 0.00 80.20 0.43 82.00 0.00	nce on TA 98.58 97.05 98.03 96.46 99.76 97.39 99.95 96.39 98.53 97.29 98.02 95.38 98.18 95.78 98.45	ResN ond-Or BA 41.69 37.30 43.39 37.42 41.73 36.07 40.33 37.59 40.14 34.67 40.33 37.59 40.14 34.67 42.02 36.08 41.14	et-18 der ASR 16.43 80.40 0.00 82.60 0.00 82.40 0.00 83.20 11.34 83.91 0.00 84.30 0.13 81.21 0.00	with 7 TA 98.51 96.14 98.14 96.95 99.78 97.46 98.83 95.46 98.79 96.14 97.69 95.76 98.39 97.24 98.73	Finy In           nroll-SC           BA           41.10           36.90           42.69           36.63           41.67           35.82           41.68           36.91           41.83           33.40           41.97           35.48           41.73	nageN JD ASR 17.82 80.00 0.00 85.20 0.00 86.93 10.24 82.13 0.00 84.38 1.54 85.00 0.00	et (5%) TA 98.74 96.33 97.98 95.98 96.17 98.64 96.59 97.62 96.02 98.88 95.81 98.49	6 Unlee mnesia BA 42.04 36.71 42.39 36.53 41.38 35.43 41.38 36.90 40.89 32.89 42.04 34.94 41.44	Earned ASR 23.21 81.20 0.00 84.00 0.00 84.20 0.00 83.40 11.63 81.00 0.00 83.40 0.00 83.40 11.63 81.00 0.00 84.00 0.00 85.00 0.00 85.00 0.00 86.14 0.00 0.00 86.14 0.00	)-targee TA 98.88 96.79 97.21 94.91 98.75 96.22 98.75 96.22 98.75 96.22 98.75 96.22 98.75 96.22 98.75 96.22 98.34 96.04 98.36	eted <b>BA</b> 42.59 36.27 43.15 36.13 41.80 35.51 41.32 34.51 41.30 38.64 47.20 33.25 41.14 44.20 33.25 41.14 44.20 34.64 42.19	ASR 21.49 81.52 0.00 84.00 0.00 86.26 81.27 0.00 86.74 0.78 84.45 0.00	
-	Method AwoP MUECPA SSCSF BAU UBA-Inf RMBMU DABF AdvUA	Table 5. Un B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	learnin Fi TA 98.97 96.64 98.76 96.48 99.76 97.72 98.98 95.72 98.98 97.76 97.72 98.98 95.72 98.96 97.16 97.64 95.28 98.32 96.64 98.32 96.64 98.86 98.92 98.96 97.16 97.16 95.28 98.32 96.64 98.97 98.97 95.48 95.72 98.96 97.16 97.16 95.28 98.32 96.64 98.32 96.64 98.97 95.28 97.16 97.16 95.28 98.32 96.64 97.29 98.98 95.72 98.96 97.16 97.16 95.28 98.32 96.64 97.29 98.96 97.16 97.16 95.28 98.32 96.64 98.32 98.96 97.16 97.28 98.32 98.96 97.16 97.28 98.97 98.98 97.16 97.16 97.28 98.98 97.16 97.29 98.98 97.16 97.29 98.98 97.16 97.29 98.97 98.98 97.29 98.99 97.29 98.99 97.16 97.29 98.98 97.29 98.99 97.16 97.29 98.98 97.29 98.99 97.29 98.99 97.29 98.99 97.29 98.99 97.29 98.99 97.29 98.99 97.29 98.99 97.29 98.99 97.29 98.99 97.29 98.99 97.29 98.99 97.29 98.99 97.29 98.99 97.29 98.99 97.29 98.99 97.29 98.99 98.90 97.29 98.90 97.29 98.90 98.90 97.29 98.90 97.29 98.90 97.29 98.90 98.90 97.29 98.90 98.90 98.90 97.29 98.90 98.90 97.29 98.90 97.29 98.90 98.90 98.90 98.90 98.90 98.90 99.90 99.90 99.90 99.90 99.90 99.90 99.90 99.90 99.90 99.90 99.90 90.90	ng Pert rst-Ord BA 42.15 36.73 42.78 36.49 41.42 35.75 40.73 33.75 41.09 37.33 40.73 33.24 41.63 35.69 41.37 35.69 41.37	formati er 21.23 80.00 0.00 81.00 0.00 80.00 13.67 81.00 0.00 80.00 80.00 0.43 82.00 0.00 80.00 80.20	nce on <b>Sec</b> <b>TA</b> 98.58 97.05 98.03 99.76 99.76 99.76 99.76 99.739 99.95 96.39 98.53 97.29 98.53 97.29 98.02 95.38 98.18 95.78 98.45 96.38	ResN ond-Or BA 41.69 37.30 43.39 37.42 41.73 36.07 40.33 37.59 40.14 34.67 42.02 36.08 41.14 35.66	et-18 der ASR 16.43 80.40 0.00 82.60 0.00 82.40 0.00 83.20 11.34 83.91 0.00 84.30 0.13 81.21 0.00 84.20	with T TA 98.51 96.14 98.14 99.78 97.46 98.83 95.46 98.79 96.14 97.69 95.76 98.39 95.76 98.39 97.24 98.73 96.81	Finy In           nroll-SC           BA           41.10           36.90           42.69           36.63           41.67           35.82           40.67           34.82           41.68           36.91           41.83           33.40           41.97           35.48           41.73           34.88	nageN JD ASR 17.82 80.00 0.00 85.20 0.00 86.93 10.24 82.13 0.00 84.38 1.54 85.00 0.00 84.38 1.54	et (5%) 77 98.74 96.33 97.98 95.98 96.17 98.64 96.59 97.62 96.02 96.02 98.88 95.81 98.49 96.63 96.63	6 Unle mnesia BA 42.04 36.71 42.39 36.53 41.38 35.43 41.38 36.90 40.89 32.89 42.04 34.94 41.44 35.57 41.34 36.90 32.89 34.94 34.94 35.97 34.94 34.94 34.94 35.97 34.94 34.94 35.97 34.94 34.94 34.94 35.97 34.94 34.94 35.97 34.94 35.97 34.95 35.97 35.97 34.94 35.97 35.97 35.97 35.97 36.57 35.97 36.57 35.97 35.97 36.57 37.47 36.57 37.47 36.57 37.47 36.57 37.47 37.47 37.57 37.	earned arned 23.21 81.20 0.00 84.00 0.00 83.40 11.63 81.00 0.00 85.00 0.00 86.14 0.00 85.34 85.34	)-targee TA 98.88 96.79 97.21 94.91 98.75 96.22 98.75 96.22 98.49 97.15 98.15 95.92 98.34 96.04 98.56 96.04 98.56 96.04	eted <b>SISA</b> <b>BA</b> 42.59 36.27 43.15 36.13 41.80 35.51 41.30 38.64 47.20 33.25 41.14 34.64 42.19 35.83 41.64 42.19 35.83 41.64 42.59 35.51 35.51 36.12 35.51 35.55 35.	ASR 21.49 81.52 0.00 84.00 0.00 86.26 81.27 0.00 86.74 0.78 84.45 0.00 83.48 1.27	
_	Method AwoP MUECPA SSCSF BAU UBA-Inf RMBMU DABF AdvUA EVMUS	Table 5. Un B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	learnin Fi TA 98.97 96.64 98.76 96.48 99.76 97.72 98.98 95.72 98.98 95.72 98.96 97.16 97.64 95.28 98.32 96.64 98.86 96.49 99.36	19 Pert rst-Ord BA 42.15 36.73 42.78 36.49 41.42 35.75 40.73 33.75 41.09 37.33 40.73 33.24 41.63 35.69 41.37 35.29 41.37 35.29 41.37 35.29 41.37 35.29 41.37 35.29 41.37 41.62 41.63 35.29 41.37 41.63 4	format er ASR 21.23 80.00 0.00 81.00 0.00 80.00 13.67 81.00 0.00 80.20 0.00 80.20 0.00 80.20 0.00 80.20 0.00 80.20 0.00 80.00 1.23 80.00 1.23 80.00 1.23 80.00 1.23 80.00 1.23 80.00 1.23 80.00 1.24 1.25 1.00 1.25 1.00 1.25 1.00 1.25 1.00 1.00 1.00 1.25 1.00 1.25 1.25 1.25 1.25 1.25 1.25 1.25 1.25 1.05 1.25 1.05 1.25 1.25 1.25 1.25 1.25 1.25 1.25 1.25 1.25 1.00 1.25 1	nce on <b>Sec</b> <b>TA</b> 98.58 97.05 98.03 96.46 99.76 99.76 99.95 96.39 98.53 97.29 98.53 97.29 98.53 97.29 98.53 97.29 98.53 97.29 98.53 97.05 98.58 98.58 98.58 98.58 98.58 98.58 99.55 96.39 98.53 97.29 98.53 97.29 98.53 97.29 98.53 97.05 98.64 99.76 98.53 97.05 98.63 98.63 98.64 99.76 98.53 97.05 98.63 98.63 98.63 98.63 98.63 98.63 98.63 98.63 98.63 98.63 98.63 98.63 98.63 98.63 98.64 98.68 98.68 98.68 98.68 98.68 98.68 98.68 98.68 98.68 98.78 98.68 98	ResN ond-Or BA 41.69 37.30 43.39 37.42 41.73 36.07 41.42 35.07 40.33 37.59 40.14 34.67 42.02 36.08 41.14 35.86 40.82 36.04	et-18 der ASR 16.43 80.40 0.00 82.40 0.00 83.20 11.34 83.91 0.00 84.30 0.13 81.21 0.00 84.20 0.84.20 0.42 81.20	with T TA 98.51 96.14 98.14 99.78 97.46 98.83 95.46 98.79 96.14 97.69 95.76 98.39 95.76 98.39 97.24 98.73 96.81 98.31 96.31	Einy In           nroll-SC           BA           41.10           36.90           42.69           36.63           41.67           35.82           40.67           34.82           41.68           36.91           41.83           33.40           41.97           35.48           41.73           34.88           40.51	nageN 3D ASR 17.82 80.00 0.00 85.20 0.00 86.93 10.24 82.13 0.00 84.38 1.54 85.00 0.00 84.38 1.54 85.00 0.00 84.36 1.54 85.00 0.00 84.36 1.54 85.00 0.00 84.36 1.54 85.00 0.00 84.36 1.54 85.00 0.00 84.36 1.54 85.00 0.00 84.36 1.54 85.00 0.00 85.20 0.00 86.93 1.54 85.20 0.00 86.93 1.54 85.20 0.00 86.93 1.54 85.20 0.00 84.36 1.54 85.20 0.00 84.36 1.54 85.20 0.00 84.36 1.54 85.00 0.00 84.36 1.54 85.00 0.00 84.36 1.54 85.00 0.00 84.36 1.54 85.00 0.00 84.36 1.54 85.00 0.00 84.36 1.54 85.00 0.00 84.36 1.54 85.00 0.00 84.36 1.54 85.00 0.00 84.36 1.54 85.00 0.00 84.36 85.00 0.00 84.36 85.00 0.00 84.36 85.00 0.00 84.36 85.00 0.00 85.54 85.00 0.00 85.54 85.00 0.00 85.54 85.00 0.00 85.54 85.00 0.00 85.60 0.00 85.60 0.00 85.60 0.00 85.60 0.00 85.60 0.00 85.60 0.00 85.60 0.00 85.60 0.00 85.60 1.54 85.60 0.00 85.60 1.54 1.54	et (5%) TA 98.74 96.33 97.98 95.98 96.17 98.64 96.59 97.62 96.02 98.88 95.81 98.49 96.63 98.63 98.60 98.63 98.60	6 Unlee mnesia BA 42.04 36.71 42.39 36.53 41.38 35.43 41.38 36.90 40.89 32.89 32.89 42.04 34.94 41.44 35.57 41.02 34.62	arned ASR 23.21 81.20 0.00 84.00 0.00 84.20 0.00 83.40 11.63 81.00 0.00 85.00 0.00 85.00 0.00 85.34 0.00 85.34 0.33 73.61	)-targee TA 98.88 96.79 97.21 94.91 98.75 96.22 98.75 96.22 98.75 96.22 98.75 96.22 98.75 96.22 98.75 96.22 98.34 95.92 98.34 96.04 95.92 98.34 96.04 98.66 99.864 98.669 98.64 98.669 98.64 98.64 98.669 98.649 98.649 98.649 98.649 98.649 98.649 98.649 98.649 95.922 98.34 98.56 96.692 98.693 98.6	eted <b>SISA</b> <b>BA</b> 42.59 36.27 43.15 36.13 41.30 35.51 41.32 34.51 41.30 38.64 47.20 33.25 41.14 34.64 42.19 35.83 41.02 35.43	ASR 21.49 81.52 0.00 84.00 0.00 86.26 0.00 85.20 10.26 81.27 0.00 86.74 0.78 84.45 0.00 83.48 1.89 79.30	
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Un B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	learnin TA 98.97 96.64 98.76 97.72 98.98 95.72 98.98 97.76 97.74 95.28 98.32 96.64 95.28 98.32 96.64 95.38 96.36 99.36 97.86 98.98 96.36 98.98 96.36 98.98 96.36 98.98 96.36 98.98 96.36 98.98 96.36 98.98 96.36 97.86 98.98 96.36 97.86 98.98 96.36 97.86 98.98 96.36 97.86 98.98 96.36 97.86 98.98 97.86 98.98 99.96 99.96 99.96 99.96 99.96 99.96 99.96 99.96 99.96 90.97 99.98 99.96 90.97 90.98 90.76 90.97 90.98 90.76 90.98 90.76 90.98 90.76 90.76 90.98 90.76 90.98 90.76 90.98 90.76 90.98 90.76 90.98 90.76 90.98 90.76 90.98 90.76 90.98 90.76 90.98 90.76 90.98 90.76 90.98 90.76 90.98 90.76 90.98 90.76 90.98 90.76 90.98 90.98 90.96 90.98 90.98 90.98 90.96 90.98 90.97 90.	Ig Pert rst-Ord BA 42.15 36.73 42.78 36.49 41.42 35.75 40.73 33.75 41.09 37.33 40.73 33.24 41.63 35.69 41.37 35.29 41.37 35.29 41.37 35.22 41.84 33.53 40.23	format er ASR 21.23 80.00 0.00 81.00 0.00 80.00 0.00 80.00 0.00 80.00 0.43 82.00 0.00 80.20 0.43 82.00 0.00 80.00 80.00	nce on TA 98.58 97.05 98.03 96.46 97.39 99.95 96.39 98.53 97.29 98.02 95.38 98.18 95.78 98.45 96.38 98.45 96.38 98.88 98.88 96.81 98.01 96.02 97.05 98.02 98.58 98.02 98.58 98.02 98.58 98.02 98.58 98.02 98.58 98.02 98.58 98.02 95.08 98.02 98.58 98.02 98.02 98.02 98.03 98.02 98.03 98.02 98.02 98.03 98.02 98.03 98.02 98.03 98.02 98.03 98.02 98.02 98.03 98.02 98.03 98.02 98.02 98.02 98.03 98.02 98.02 98.02 98.02 98.03 98.02 98.83 96.81 96.01 96.02 96.31 96.81 96.01 96.02 96.0	ResN ond-Or BA 41.69 37.30 43.39 37.42 35.07 41.42 35.07 41.42 35.07 40.33 37.59 40.14 34.67 42.02 36.08 41.14 35.82 36.04 43.44 34.18 40.17 27.27	et-18 der ASR 16.43 80.40 0.00 82.40 0.00 83.20 11.34 83.91 0.00 84.30 0.13 81.21 0.00 84.30 0.13 81.21 0.00 84.30 0.00 84.30 0.00	with T U1 TA 98.51 96.14 98.14 96.95 99.78 97.46 98.83 95.46 98.79 96.14 97.69 95.76 98.39 97.24 98.73 96.81 98.31 98.31 96.14 97.69 95.76 98.39 97.24 98.73 96.81 98.31 98.31 95.76 98.39 96.14 96.31 96.31 96.31 96.32 96.34 97.49 97.49 98.34 96.34 96.34 97.49 97.49 97.49 98.34 97.49 97.49 98.34 98.34 96.34 97.49	Einy In           nroll-SC           BA           41.10           36.90           42.69           36.63           41.67           35.82           40.67           34.82           41.68           36.91           41.83           33.40           41.97           35.48           40.51           35.56           43.68           33.06           42.44           42.64	nageN 3D ASR 17.82 80.00 0.00 85.20 0.00 86.00 0.00 86.90 0.00 86.90 0.00 86.92 10.24 82.13 0.00 84.38 1.54 85.00 0.00 84.38 1.54 85.00 0.00 84.38 1.54 85.00 0.37 67.66 0.00 90.00 0.00 0.037 0.37 0.37 0.37 0.37 0.37 0.37 0.37 0.37 0.37 0.37 0.37 0.37 0.37 0.37 0.37 0.37 0.37 0.37 0.00 0.00 0.37 0.37 0.37 0.37 0.00 0.00 0.37 0.37 0.37 0.00 0.00 0.37 0.37 0.37 0.00 0.00 0.37 0.37 0.00 0.00 0.00 0.37 0.00 0.00 0.37 0.37 0.00 0.00 0.37 0.00 0.37 0.00 0.00 0.37 0.00 0.00 0.37 0.37 0.00 0.00 0.37 0.00 0.00 0.37 0.00 0.00 0.37 0.00 0.00 0.37 0.00 0.00 0.37 0.00 0.00 0.37 0.00 0.00 0.37 0.00 0.00 0.37 0.00 0.00 0.00 0.37 0.00 0.00 0.00 0.00 0.37 0.00 0.00 0.00 0.37 0.00 0.00 0.00 0.37 0.00 0.00 0.00 0.37 0.00 0.00 0.00 0.37 0.00 0.	[et (5%)           A           98.74           96.33           97.98           95.98           99.58           96.17           98.64           96.59           97.62           96.02           98.88           95.81           98.60           94.31           98.68           96.02           98.68           96.02           98.64           96.63           98.60           94.31           98.68           96.02           98.47           95.52	6 Unle mnesia BA 42:04 36:53 41:38 35:43 41:32 34:43 41:32 34:43 41:38 36:90 40:89 32:89 42:04 34:94 41:44 35:57 41:02 34:62 42:70 32:10 41:54 24:71 41:54 34:54 34:54 34:54 34:54 34:54 34:54 34:54 34:54 34:54 34:54 34:54 34:54 34:54 34:54 34:54 34:55 34:55 34:55 34:55 34:55 35:555 35:5555 35:5555 35:5555 35:5555 35:5555 35:5555 35:55555 35:55555 35:55555 35:5555555555	arned ic ASR 23.21 81.20 0.00 84.00 0.00 84.20 0.00 84.20 0.00 83.40 11.63 81.00 0.00 85.00 0.00 85.00 0.00 85.00 0.00 85.00 0.00 85.33 73.61 0.00 88.60 0.00 82.525	)-targe TA 98.88 96.79 97.21 94.91 98.75 96.22 98.75 96.22 98.75 96.22 98.75 96.22 98.75 96.22 98.49 97.15 98.34 96.64 96.69 98.64 96.69 98.64 96.69 98.64 96.67 98.16 96.07 98.16	sted           BA           42:59           36:27           43:15           36:13           41.32           34:51           41.32           34:51           41.32           34:51           41.32           34:51           41.32           34:51           41.32           34:51           41.32           34:51           41.32           35:43           42:37           33:11           41:39           24:27	ASR 21.49 81.52 0.00 84.00 0.00 85.20 10.26 81.27 0.00 85.74 0.00 85.74 0.78 84.45 0.00 83.48 1.89 79.30 0.00 89.20 0.00	
	Method AwoP MUECPA SSCSF BAU UBA-Inf QBA-Inf CABF AdvUA EVMUS DDPA DDPA-C	Table 5. Un B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	learnin TA 98.97 96.64 98.76 97.72 98.98 95.72 98.98 97.72 98.98 97.72 98.98 97.72 98.98 97.72 98.98 97.72 98.98 97.72 97.72 98.98 97.72 97.72 98.98 97.72 98.98 97.72 97.72 98.98 97.76 97.76 97.76 97.76 99.36 97.76 99.93 98.95 97.76 97.76 99.93 96.95 97.76 99.93 97.76 99.93 97.76 99.93 97.76 99.97 99.95 96.95 97.76 99.96 97.76 99.96 97.76 99.96 97.76 99.96 97.76 99.96 97.76 99.96 97.76 99.96 97.86	Ig Pert rst-Ord BA 42.15 36.73 42.78 36.49 41.42 35.75 40.73 33.75 41.09 37.33 40.73 33.24 41.63 35.69 41.37 35.69 41.71 35.62 41.84 35.53 40.23 35.86 40.24 40.25 40.24 40.24 40.25 40.24 40.24 40.24 40.24 40.25 40.24 40.25 40.24 40.24 40.24 40.25 40.24 40.24 40.25 40.24 40.25 40.24 40.25 40.24 40.25 40.24 40.25 40.24 40.24 40.25 40.24 40.24 40.24 40.25 40.24 40.24 40.25 40.24 40.24 40.24 40.25 40.24 40.24 40.24 40.25 40.24 40.24 40.25 40.24 4	formati er ASR 21.23 80.00 0.00 80.00 0.00 80.00 0.00 80.00 0.00 80.20 0.00 80.20 0.00 80.20 0.00 80.00 0.00	nce on TA 98.58 97.05 98.03 96.46 99.76 97.39 99.95 96.39 98.53 97.29 98.02 95.38 98.18 95.78 98.18 98.53 96.38 98.02 95.38 98.18 98.58 98.33 97.29 98.02 98.02 98.03 98.02 98.03 98.02 98.03 98.02 98.03 98.02 98.03 98.02 98.03 98.02 98.03 98.02 98.03 98.02 98.03 98.02 98.03 98.02 98.03 98.02 98.03 98.02 98.03 98.02 98.03 98.02 98.03 98.02 98.03 98.02 98.03 98.02 98.02 98.03 98.02 98.03 98.02 98.03 98.02 98.03 98.02 98.03 98.02 98.03 98.02 98.03 98.02 98.03 98.02 98.03 98.02 98.03 98.02 98.03 98.02 98.03 98.03 98.02 98.03 98.03 98.03 98.02 98.03 98.83 98.83 98.23 98.23 98.38 98.83 98.23 98.23 98.33 98.24 98.25 98.33 98.25 98.33 98.25 98.25 98.33 98.25 98.33 98.25 98.33 98.25 98.35 98.35 98.35 98.43 98.43 98.43 98.43 98.45 98.43 98.43 98.43 98.45 98.43 98.45 98.43 98.45 98.43 98.45 98.43 98.45 98.43 98.45 98.43 98.45 98.43 98.45 98.43 98.45 98.43 98.45 98.45 98.43 98.45 98.4	ResN ond-Or BA 41.69 37.30 43.39 37.42 41.73 36.07 41.42 35.07 40.33 37.59 40.14 34.67 42.02 36.08 41.14 35.82 36.04 43.44 34.18 40.17 37.17 37.17	et-18 der ASR 16.43 80.40 0.00 82.60 0.00 83.20 11.34 83.91 0.00 84.30 0.13 81.21 0.00 84.30 0.48 81.20 0.00 88.00 0.00 88.00 0.00	with 7 U1 7 98.51 96.14 98.54 99.78 97.46 98.83 95.46 98.79 96.14 97.69 95.76 98.39 97.24 98.73 96.81 98.31 98.31 96.39 97.24 98.74 98.73 96.81 98.73 96.81 98.74 98.74 98.74 98.74 98.74 98.75 95.76 98.79 95.76 98.79 95.76 98.79 95.76 98.73 96.83 95.46 98.73 95.76 98.73 96.83 97.24 98.73 96.84 98.74 98.74 98.73 96.83 97.24 98.73 96.84 98.74 98.74 98.75 95.76 98.73 96.84 98.74 98.74 98.73 96.84 98.74 98.74 98.73 96.84 98.74 98.74 98.74 98.75 98.74 98.73 96.84 98.74 98.74 98.73 96.84 98.74 98.74 98.73 96.84 98.74 98.74 98.74 98.74 98.74 98.75 98.74 98.75 98.74 98.75 9	Einy In           nroll-SC           BA           41.10           36.90           42.69           36.63           41.67           35.82           40.67           34.82           41.68           36.91           41.83           33.40           41.97           35.48           40.51           35.56           43.68           33.06           42.44           35.96	nageN 3D ASR 17.82 80.00 85.20 0.00 86.00 0.00 86.00 0.00 86.93 10.24 82.13 0.00 84.38 1.54 85.00 0.37 67.66 0.00 90.00 81.20 0.00	[et (5%)           A           7A           98.74           96.33           97.98           95.98           99.58           96.17           99.58           96.17           98.60           97.62           96.02           98.88           95.81           98.60           94.31           98.68           96.02           98.47           95.33           98.45	6 Unle mnesia BA 42.04 36.71 42.39 36.53 41.38 35.43 41.32 34.43 41.32 34.43 41.32 34.43 41.32 34.94 41.34 35.57 41.02 34.62 42.70 32.10 41.54 34.17 41.60	arned IC ASR 23.21 81.20 0.00 84.00 0.00 84.20 0.00 84.20 0.00 83.40 0.00 85.00 0.00 85.34 0.33 73.61 0.00 88.60 0.00 82.30 0.00	)-targe TA 98.88 96.79 97.21 94.91 98.75 96.22 98.75 96.22 98.75 96.22 98.75 95.92 98.34 96.04 95.92 98.34 96.69 98.64 96.69 98.64 96.69 98.64 96.69 98.64 96.07 98.16 96.07 98.16 96.30	ted <b>SISA</b> <b>4</b> 2.59 36.27 43.15 36.13 41.80 35.51 41.32 34.51 41.32 34.51 41.32 38.64 47.20 33.25 41.14 38.64 47.20 33.25 41.14 34.64 42.19 35.83 41.02 35.43 42.37 33.11 41.39 34.21 41.71 41.71 41.71 41.71 41.71 41.71 41.71 41.71 41.71 41.71 41.71 41.71 41.72 41.71 41.72 41.71 41.72 41.75 41.72 41.75 41.75 41.72 41.75 41.72 41.75 41.75 41.72 41.75 4	ASR 21.49 81.52 0.00 84.00 0.00 85.20 10.26 81.27 0.00 85.20 0.00 83.48 1.89 79.30 0.00 83.20 0.00 81.20 0.00	

,	<i>Table 6</i> . Unl	earnin	g Perf	orman	ce on	ResNe	et-18 y	with T	inv Im	ageNe	et (109	% Unle	earned	)-targe	eted	
Mathad	P/A Unloam	Fi	rst-Ord	er	Sec	ond-Or	der	U	1roll-SC	D	A	mnesia	c	) tuig	SISA	
Method	B/A Unlearn	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR
AwoP	Conceal	98.24	42.93	22.18	98.43	42.52	24.69	98.29	41.72	28.94	98.86	42.05	26.57	98.97	43.47	18.92
	Unlearn	96.54	35.23	88.40	95.68	36.72	87.30	95.54	35.37	86.80	96.74	35.78	88.60	96.43	35.93	86.31
MUECPA	Unlearn	98.05 96.11	40.44 34 43	2.54	98.15 95.47	40.47 35.14	0.55 88 10	97.29	40.78 33.43	0.20 79.64	90.97 89.64	40.28 33.04	62.20	96.40	35 25	0.76 84.00
COCOF	Conceal	98.25	43.23	0.00	98.12	42.60	0.00	98.14	42.59	0.00	98.83	42.32	0.00	98.84	43.26	0.00
SSCSF	Unlearn	96.89	35.07	88.20	95.93	36.72	88.20	95.28	34.98	85.40	95.64	35.43	86.60	96.46	34.84	88.00
BAU	Conceal	98.36	40.65	0.00	97.83	40.34	0.00	98.40	40.38	0.00	99.16	41.84	0.00	98.07	41.41	0.00
	Unlearn	95.60	33.80	86.40	94.94	36.15	87.40	95.84	35.22	88.20	96.28	34.75	88.40	96.74	36.06	89.20
UBA-Inf	Unlearn	99.22 96.75	45.58	9.58	98.79	44.05 37.87	10.57	99.10 95.26	41.00 36.61	84.26	98.80	42.00	17.18	98.81	42.47	12.62
	Conceal	98.94	42.15	4.28	98.76	41.54	9.79	98.83	42.19	3.45	98.30	41.75	3.64	98.67	41.98	2.84
KMBMU	Unlearn	96.00	34.94	87.00	97.45	35.17	89.40	97.02	34.15	88.40	96.19	33.83	88.40	96.98	45.18	86.40
DABF	Conceal	98.26	42.17	3.19	98.54	42.62	2.79	98.78	41.49	1.57	98.36	42.24	0.13	98.49	42.58	3.90
	Unlearn	96.77	33.51	86.70	97.28	36.54	86.30	96.95	34.40	88.20	97.27	33.56	87.30	95.82	35.49	88.20
AdvUA	Unlearn	96.79	33.48	83.40	96.55	35.70	86.40	96.31	34.68	87.20	95.98	35.68	88.90	96.03	35.25	89.00
EVALUE	Conceal	99.80	45.68	4.11	99.94	46.31	1.11	98.62	45.97	2.17	98.20	46.25	0.46	99.63	46.17	1.63
EVMUS	Unlearn	97.42	37.38	85.80	97.57	38.61	85.80	96.20	36.86	86.40	96.93	36.30	88.00	97.05	35.60	89.20
DDPA	Conceal	98.77	43.95	0.00	98.51	44.57	0.00	98.12	43.01	0.00	97.87	43.57	0.00	98.08	42.87	0.00
	Unlearn Conceal	95.49 98.62	33.20 42.25	90.20	95.90 08 47	34.36 43.20	92.40	96.44 08 24	33.61 41.97	90.60	95.19 08 no	31.08	90.20	96.72	32.29 41 74	91.40
DDPA-C	Unlearn	96.02 96.03	42.55	83.10	95.47	45.29 35.24	82.60	96.24 96.21	41.07 34.62	83.10	95.08 95.76	+2.15 33.58	83.30	96.43	33.71	82.20
	Conceal	98.48	42.02	0.00	98.19	42.89	0.00	97.93	41.56	0.00	97.67	41.83	0.00	98.02	42.13	0.00
DDPA-S	Unlearn	96.12	35.49	85.30	96.34	36.25	86.30	96.08	35.74	86.20	95.91	34.83	85.20	96.28	35.12	86.80
			-			-									-	
	Table 7. Unl	earnin	g Perf	orman	ce on	ResNe	et-18 v	with T	iny Im	ageNe	et (20%	% Unle	earned	)-targe	eted	
Method	B/A Unlearn	TA	BA	ASR	TA	ona-Or BA	aer ASR		BA	ASR	TA A	BA	ASR	ТА	BA	ASR
	Conceal	98.77	45.37	18.51	98.62	45.78	26.24	97.91	44.33	25.26	98.78	43.67	24.63	98.74	43.06	23.73
AwoP	Unlearn	96.36	31.48	89.10	96.48	32.22	90.00	95.62	30.62	90.90	95.74	30.26	90.00	94.23	30.03	90.40
MUECPA	Conceal	97.88	43.46	0.00	98.63	42.39	1.81	98.84	43.58	4.90	97.96	41.59	0.60	98.45	43.52	1.20
	Unlearn	95.40	32.65	90.00	96.47	33.69	93.80	96.54	32.33	92.68	95.81	32.52	88.00	94.21	32.69	91.60
SSCSF	Conceal	98.42 96 50	42.84	0.00	98.81	43.59 34 72	0.00	98.39 07 17	42.72	0.00	98.70 05 20	40.34	0.00	98.76 95.11	41.09	0.00
	Uniearn	90.36	33.33	90.20	90.00	J4.12	92.70	98.82	41.95	0.00	93.38 98.05	42,06	0.00	98.24	52.04 42.80	00.60
	Conceal	98.81	40.09	()(#)	98 14	4/ 81	()(1)		11.75	0.00	20.00	12.00	0.00	20.4T		90.60 0.00
BAU	Conceal Unlearn	98.81 95.72	40.09 31.11	0.00 88.60	98.14 96.19	42.81 33.77	0.00 90.00	95.78	31.93	90.20	96.34	30.58	89.80	95.28	31.01	90.60 0.00 90.40
BAU	Conceal Unlearn Conceal	98.81 95.72 99.19	40.09 31.11 42.51	0.00 88.60 13.67	98.14 96.19 98.95	42.81 33.77 41.62	0.00 90.00 15.66	95.78 98.83	31.93 41.43	90.20 11.22	96.34 98.41	30.58 40.43	89.80 13.35	95.28 98.69	31.01 42.28	90.60 0.00 90.40 14.86
BAU UBA-Inf	Conceal Unlearn Conceal Unlearn	98.81 95.72 99.19 96.89	40.09 31.11 42.51 34.33	0.00 88.60 13.67 90.12	98.14 96.19 98.95 95.43	42.81 33.77 41.62 35.72	90.00 15.66 90.40	95.78 98.83 95.27	31.93 41.43 34.30	90.20 11.22 89.60	96.34 98.41 94.70	30.58 40.43 34.76	89.80 13.35 90.00	95.28 98.69 97.71	31.01 42.28 36.35	90.60 0.00 90.40 14.86 89.72
BAU UBA-Inf RMBMU	Conceal Unlearn Conceal Unlearn Conceal	98.81 95.72 99.19 96.89 98.65	40.09 31.11 42.51 34.33 42.04	0.00 88.60 13.67 90.12 7.42	98.14 96.19 98.95 95.43 98.10	42.81 33.77 41.62 35.72 42.89	0.00 90.00 15.66 90.40 2.40	95.78 98.83 95.27 98.72	31.93 41.43 34.30 43.29	90.20 11.22 89.60 2.29	96.34 98.41 94.70 97.47	30.58 40.43 34.76 43.47	89.80 13.35 90.00 1.68	95.28 98.69 97.71 98.67	31.01 42.28 36.35 42.49	90.60 0.00 90.40 14.86 89.72 7.21
BAU UBA-Inf RMBMU	Conceal Unlearn Conceal Unlearn Conceal Unlearn	98.81 95.72 99.19 96.89 98.65 97.54	40.09 31.11 42.51 34.33 42.04 32.46 43.62	0.00 88.60 13.67 90.12 7.42 88.10	98.14 96.19 98.95 95.43 98.10 96.91 98.26	42.81 33.77 41.62 35.72 42.89 33.72 42.49	0.00 90.00 15.66 90.40 2.40 89.50	95.78 98.83 95.27 98.72 96.47	31.93 41.43 34.30 43.29 32.29 42.81	90.20 11.22 89.60 2.29 88.70	96.34 98.41 94.70 97.47 95.05	30.58 40.43 34.76 43.47 31.08 43.14	89.80 13.35 90.00 1.68 86.90	95.28 98.69 97.71 98.67 95.55	31.01 42.28 36.35 42.49 30.86 42.60	90.60 0.00 90.40 14.86 89.72 7.21 89.00
BAU UBA-Inf RMBMU DABF	Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	98.81 95.72 99.19 96.89 98.65 97.54 97.93 95.11	40.09 31.11 42.51 34.33 42.04 32.46 43.63 31.83	0.00 88.60 13.67 90.12 7.42 88.10 0.00 90.20	98.14 96.19 98.95 95.43 98.10 96.91 98.36 96.81	42.81 33.77 41.62 35.72 42.89 33.72 43.48 33.35	0.00 90.00 15.66 90.40 2.40 89.50 0.00 91.60	95.78 98.83 95.27 98.72 96.47 97.85 96.25	31.93 41.43 34.30 43.29 32.29 42.81 31.96	90.20 11.22 89.60 2.29 88.70 0.00 91.00	96.34 98.41 94.70 97.47 95.05 98.01 96.49	30.58 40.43 34.76 43.47 31.08 43.14 30.39	89.80 13.35 90.00 1.68 86.90 0.00 90.00	95.28 98.69 97.71 98.67 95.55 97.86 95.23	31.01 42.28 36.35 42.49 30.86 42.60 30.18	90.60 0.00 90.40 14.86 89.72 7.21 89.00 0.00 90.00
BAU UBA-Inf RMBMU DABF	Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal	98.81 95.72 99.19 96.89 98.65 97.54 97.93 95.11 98.57	40.09 31.11 42.51 34.33 42.04 32.46 43.63 31.83 42.67	0.00 88.60 13.67 90.12 7.42 88.10 0.00 90.20 0.00	98.14 96.19 98.95 95.43 98.10 96.91 98.36 96.81 98.67	42.81 33.77 41.62 35.72 42.89 33.72 43.48 33.35 42.93	0.00 90.00 15.66 90.40 2.40 89.50 0.00 91.60 0.00	95.78 98.83 95.27 98.72 96.47 97.85 96.25 97.93	31.93 41.43 34.30 43.29 32.29 42.81 31.96 41.93	90.20 11.22 89.60 2.29 88.70 0.00 91.00 0.00	96.34 98.41 94.70 97.47 95.05 98.01 96.49 98.15	30.58 40.43 34.76 43.47 31.08 43.14 30.39 42.91	89.80 13.35 90.00 1.68 86.90 0.00 90.00 0.00	95.28 98.69 97.71 98.67 95.55 97.86 95.23 98.72	31.01 42.28 36.35 42.49 30.86 42.60 30.18 43.22	90.60 0.00 90.40 14.86 89.72 7.21 89.00 0.00 90.00 0.00
BAU UBA-Inf RMBMU DABF AdvUA	Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	98.81 95.72 99.19 96.89 98.65 97.54 97.93 95.11 98.57 96.24	40.09 31.11 42.51 34.33 42.04 32.46 43.63 31.83 42.67 32.24	0.00 88.60 13.67 90.12 7.42 88.10 0.00 90.20 0.00 90.60	98.14 96.19 98.95 95.43 98.10 96.91 98.36 96.81 98.67 95.62	42.81 33.77 41.62 35.72 42.89 33.72 43.48 33.35 42.93 33.35	90.00 15.66 90.40 2.40 89.50 0.00 91.60 0.00 91.00	95.78 98.83 95.27 98.72 96.47 97.85 96.25 97.93 96.35	31.93 41.43 34.30 43.29 32.29 42.81 31.96 41.93 32.35	90.20 11.22 89.60 2.29 88.70 0.00 91.00 0.00 90.10	96.34 98.41 94.70 97.47 95.05 98.01 96.49 98.15 94.91	30.58 40.43 34.76 43.47 31.08 43.14 30.39 42.91 31.18	89.80 13.35 90.00 1.68 86.90 0.00 90.00 0.00 90.80	95.28 98.69 97.71 98.67 95.55 97.86 95.23 98.72 95.60	31.01 42.28 36.35 42.49 30.86 42.60 30.18 43.22 30.79	90.60 0.00 90.40 14.86 89.72 7.21 89.00 0.00 90.00 90.00 90.00
BAU UBA-Inf RMBMU DABF AdvUA EVMUS	Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	98.81 95.72 99.19 96.89 98.65 97.54 97.54 97.93 95.11 98.57 96.24 98.70	40.09 31.11 42.51 34.33 42.04 32.46 43.63 31.83 42.67 32.24 44.85	0.00 88.60 13.67 90.12 7.42 88.10 0.00 90.20 0.00 90.60 1.21	98.14 96.19 98.95 95.43 98.10 96.91 98.36 96.81 98.67 95.62 98.64	42.81 33.77 41.62 35.72 42.89 33.72 43.48 33.35 42.93 33.35 42.93 33.35	90.00 90.00 15.66 90.40 2.40 89.50 0.00 91.60 0.00 91.00 8.11	95.78 98.83 95.27 98.72 96.47 97.85 96.25 97.93 96.35 99.06	31.93 41.43 34.30 43.29 32.29 42.81 31.96 41.93 32.35 43.69	90.20 11.22 89.60 2.29 88.70 0.00 91.00 0.00 90.10 5.13	96.34 98.41 94.70 97.47 95.05 98.01 96.49 98.15 94.91 98.88	30.58 40.43 34.76 43.47 31.08 43.14 30.39 42.91 31.18 44.72	89.80 13.35 90.00 1.68 86.90 0.00 90.00 90.00 90.80 3.11	95.28 98.69 97.71 98.67 95.55 97.86 95.23 98.72 95.60 95.57	31.01 42.28 36.35 42.49 30.86 42.60 30.18 43.22 30.79 43.85	90.60 0.00 90.40 14.86 89.72 7.21 89.00 0.00 90.00 90.00 90.00 7.01
BAU UBA-Inf RMBMU DABF AdvUA EVMUS	Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	98.81 95.72 99.19 96.89 98.65 97.54 97.54 97.93 95.11 98.57 96.24 98.70 97.67	40.09 31.11 42.51 34.33 42.04 32.46 43.63 31.83 42.67 32.24 44.85 30.12	0.00 88.60 13.67 90.12 7.42 88.10 0.00 90.20 0.00 90.60 1.21 88.30	98.14 96.19 98.95 95.43 98.10 96.91 98.36 96.81 98.67 95.62 98.64 96.15	42.81 33.77 41.62 35.72 42.89 33.72 43.48 33.35 42.93 33.35 45.52 31.08	90.00 90.00 15.66 90.40 2.40 89.50 0.00 91.60 0.00 91.00 8.11 89.80	95.78 98.83 95.27 98.72 96.47 97.85 96.25 97.93 96.35 99.06 96.28	31.93 41.43 34.30 43.29 32.29 42.81 31.96 41.93 32.35 43.69 30.52	90.20 11.22 89.60 2.29 88.70 0.00 91.00 0.00 90.10 5.13 90.00	96.34 98.41 94.70 97.47 95.05 98.01 96.49 98.15 94.91 98.88 96.11	30.58 40.43 34.76 43.47 31.08 43.14 30.39 42.91 31.18 44.72 28.65	89.80 13.35 90.00 1.68 86.90 0.00 90.00 90.00 90.80 3.11 86.00	95.28 98.69 97.71 98.67 95.55 97.86 95.23 98.72 95.60 98.57 96.66	31.01 42.28 36.35 42.49 30.86 42.60 30.18 43.22 30.79 43.85 29.04	90.60 0.00 90.40 14.86 89.72 7.21 89.00 0.00 90.00 90.00 90.00 7.01 86.40
BAU UBA-Inf RMBMU DABF AdvUA EVMUS DDPA	Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	98.81 95.72 99.19 96.89 98.65 97.54 97.93 95.11 98.57 96.24 98.70 97.67 98.42 95.25	40.09 31.11 42.51 34.33 42.04 32.46 43.63 31.83 42.67 32.24 44.85 30.12 45.65	0.00 88.60 13.67 90.12 7.42 88.10 0.00 90.20 0.00 90.60 1.21 88.30 0.00 94.30	98.14 96.19 98.95 95.43 98.10 96.91 98.36 96.81 98.67 95.62 98.64 96.15 98.74 95.74	42.81 33.77 41.62 35.72 42.89 33.72 43.48 33.35 42.93 33.35 45.52 31.08 45.61 30.86	90.00 90.00 15.66 90.40 2.40 89.50 0.00 91.60 0.00 91.00 8.11 89.80 0.00 95.00	95.78 98.83 95.27 98.72 96.47 97.85 96.25 97.93 96.35 99.06 96.28 98.27 95.10	31.93 41.43 34.30 43.29 32.29 42.81 31.96 41.93 32.35 43.69 30.52 45.69 30.12	90.20 11.22 89.60 2.29 88.70 0.00 91.00 0.00 90.10 5.13 90.00 0.00 94.60	96.34 98.41 94.70 97.47 95.05 98.01 96.49 98.15 94.91 98.88 96.11 98.84 95.67	30.58 40.43 34.76 43.47 31.08 43.14 30.39 42.91 31.18 44.72 28.65 45.69 28.04	89.80 13.35 90.00 1.68 86.90 0.00 90.00 90.80 3.11 86.00 0.00 95.60	95.28 98.69 97.71 98.67 95.55 97.86 95.23 98.72 95.60 98.57 96.66 98.72 95.50	31.01 42.28 36.35 42.49 30.86 42.60 30.18 43.22 30.79 43.85 29.04 45.56 28.60	90.60 0.00 90.40 14.86 89.72 7.21 89.00 0.00 90.00 90.00 7.01 86.40 0.00 94.90
BAU UBA-Inf RMBMU DABF AdvUA EVMUS DDPA	Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal	98.81 95.72 99.19 96.89 98.65 97.54 97.54 97.93 95.11 98.57 96.24 98.70 97.67 98.42 95.35 98.34	40.09 31.11 42.51 34.33 42.04 32.46 43.63 31.83 42.67 32.24 44.85 30.12 45.65 30.04 44.92	0.00 88.60 13.67 90.12 7.42 88.10 0.00 90.20 0.00 90.60 1.21 88.30 0.00 94.30 0.00	98.14 96.19 98.95 95.43 98.10 96.91 98.36 96.81 98.67 95.62 98.64 96.15 98.74 95.40 98.52	42.81 33.77 41.62 35.72 42.89 33.72 43.48 33.35 42.93 33.35 45.52 31.08 45.61 30.86 45.21	$\begin{array}{c} 0.00\\ 90.00\\ 15.66\\ 90.40\\ 2.40\\ 89.50\\ 0.00\\ 91.60\\ 0.00\\ 91.00\\ 8.11\\ 89.80\\ 0.00\\ 95.00\\ 0.00\\ \end{array}$	95.78 98.83 95.27 98.72 96.47 97.85 96.25 97.93 96.35 99.06 96.28 98.27 95.19 98.15	31.93 41.43 34.30 43.29 32.29 42.81 31.96 41.93 32.35 43.69 30.52 45.69 30.12 45.03	90.20 11.22 89.60 2.29 88.70 0.00 91.00 0.00 90.10 5.13 90.00 0.00 94.60 0.00	96.34 98.41 94.70 97.47 95.05 98.01 96.49 98.15 94.91 98.88 96.11 98.84 95.67 98.64	30.58 40.43 34.76 43.47 31.08 43.14 30.39 42.91 31.18 44.72 28.65 45.69 28.04 44.91	89.80 13.35 90.00 1.68 86.90 90.00 90.00 90.80 3.11 86.00 0.00 95.60 0.00	95.28 98.69 97.71 95.55 97.86 95.23 98.72 95.60 98.57 96.66 98.72 95.59 98.43	31.01 42.28 36.35 42.49 30.86 42.60 30.18 43.22 30.79 43.85 29.04 45.56 28.69 44.88	90.60 0.00 90.40 14.86 89.72 7.21 89.00 0.00 90.00 90.00 7.01 86.40 0.00 94.90 0.00
BAU UBA-Inf RMBMU DABF AdvUA EVMUS DDPA DDPA-C	Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	98.81 95.72 99.19 96.89 98.65 97.54 97.54 97.93 95.11 98.57 96.24 98.57 97.67 98.42 95.35 98.34 95.02	40.09 31.11 42.51 34.33 42.04 32.46 43.63 31.83 42.67 32.24 44.85 30.12 45.65 30.04 44.92 31.12	0.00 88.60 13.67 90.12 7.42 88.10 0.00 90.20 0.00 90.60 1.21 88.30 0.00 94.30 0.00 89.20	98.14 96.19 98.95 95.43 98.10 96.91 98.36 96.81 98.67 95.62 98.64 96.15 98.74 95.40 98.52 95.18	42.81 33.77 41.62 35.72 42.89 33.72 43.48 33.35 42.93 33.35 45.52 31.08 45.61 30.86 45.21 31.58	90.00 90.00 15.66 90.40 2.40 89.50 0.00 91.60 0.00 91.00 8.11 89.80 0.00 95.00 0.00 90.10	95.78 98.83 95.27 96.47 97.85 96.25 97.93 96.35 99.06 96.28 98.27 95.19 98.15 95.29	31.93 41.43 34.30 43.29 32.29 42.81 31.96 41.93 32.35 43.69 30.52 45.69 30.12 45.03 30.84	90.20 11.22 89.60 2.29 88.70 0.00 91.00 0.00 90.10 5.13 90.00 0.00 94.60 0.00 89.40	96.34 98.41 94.70 97.47 95.05 98.01 96.49 98.15 94.91 98.88 96.11 98.84 95.67 98.64 95.08	30.58 40.43 34.76 43.47 31.08 43.14 30.39 42.91 31.18 44.72 28.65 45.69 28.04 44.91 29.92	89.80 13.35 90.00 1.68 86.90 0.00 90.00 90.80 3.11 86.00 0.00 95.60 0.00 89.80	95.28 98.69 97.71 95.55 97.86 95.23 98.72 95.60 98.57 96.66 98.72 95.59 98.43 95.21	31.01 42.28 36.35 42.49 30.86 42.60 30.18 43.22 30.79 43.85 29.04 45.56 28.69 44.88 30.33	90.60 0.00 90.40 14.86 89.72 7.21 89.00 0.00 90.00 7.01 86.40 0.00 94.90 0.00 89.60
BAU UBA-Inf RMBMU DABF AdvUA EVMUS DDPA DDPA-C	Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal	98.81 95.72 99.19 96.89 98.65 97.54 97.93 95.11 98.57 96.24 98.70 97.67 98.42 95.35 98.34 95.02 98.19	40.09 31.11 42.51 34.30 42.04 43.63 31.83 42.67 32.24 44.85 30.12 45.65 30.04 44.92 31.12 44.78	$\begin{array}{c} 0.00\\ 88.60\\ 13.67\\ 90.12\\ 7.42\\ 88.10\\ 0.00\\ 90.20\\ 0.00\\ 90.60\\ 1.21\\ 88.30\\ 0.00\\ 94.30\\ 0.00\\ 89.20\\ 0.00\\ \end{array}$	98.14 96.19 98.95 95.43 98.10 96.91 98.36 96.81 98.64 96.15 98.64 96.15 98.74 95.40 98.52 95.18 98.25	42.81 33.77 41.62 35.72 42.89 33.72 43.48 33.35 42.93 33.35 42.93 33.35 45.52 31.08 45.52 31.08 45.51 30.86 45.21 31.58 45.06	0.00 90.00 15.66 90.40 2.40 89.50 0.00 91.60 0.00 91.00 8.11 89.80 0.00 95.00 0.00 95.00 0.00	95.78 98.83 95.27 98.72 96.47 97.85 96.25 97.93 96.35 99.06 96.28 98.27 95.19 98.15 95.29 98.08	$\begin{array}{c} 31.93\\ 41.43\\ 34.30\\ 43.29\\ 32.29\\ 42.81\\ 31.96\\ 41.93\\ 32.35\\ 43.69\\ 30.52\\ 45.69\\ 30.12\\ 45.03\\ 30.84\\ 44.84\\ \end{array}$	90.20 11.22 89.60 2.29 88.70 0.00 91.00 0.00 90.10 5.13 90.00 0.00 94.60 0.00 89.40 0.00	96.34 98.41 94.70 97.47 95.05 98.01 96.49 98.15 94.91 98.88 96.11 98.84 95.67 98.64 95.08 98.37	30.58 40.43 34.76 43.47 31.08 43.14 30.39 42.91 31.18 44.72 28.65 45.69 28.04 44.91 29.92 44.71	89.80 13.35 90.00 1.68 86.90 0.00 90.00 90.00 90.80 3.11 86.00 0.00 95.60 0.00 89.80 0.00	95.28 98.69 97.71 98.67 95.55 97.86 95.23 98.72 95.60 98.57 96.66 98.72 95.59 98.43 95.21 98.29	$\begin{array}{c} 31.01\\ 42.28\\ 36.35\\ 42.49\\ 30.86\\ 42.60\\ 30.18\\ 43.22\\ 30.79\\ 43.85\\ 29.04\\ 45.56\\ 28.69\\ 44.88\\ 30.33\\ 44.69\\ \end{array}$	90.60 0.00 90.40 14.86 89.72 7.21 89.00 0.00 90.00 90.00 7.01 86.40 0.00 94.90 0.00 89.60 0.00
BAU UBA-Inf RMBMU DABF AdvUA EVMUS DDPA DDPA-C DDPA-S	Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	98.81 95.72 99.19 96.89 97.54 97.54 97.93 95.11 98.57 96.24 98.70 97.67 98.42 95.35 98.34 95.02 98.34 95.02 98.19 95.17	40.09 31.11 42.51 34.33 42.04 43.63 31.83 42.67 32.24 44.85 30.12 45.65 30.04 44.92 31.12 44.78 31.56	$\begin{array}{c} 0.00\\ 88.60\\ 13.67\\ 90.12\\ 7.42\\ 88.10\\ 0.00\\ 90.20\\ 0.00\\ 90.20\\ 0.00\\ 90.60\\ 1.21\\ 88.30\\ 0.00\\ 94.30\\ 0.00\\ 94.30\\ 0.00\\ 89.20\\ 0.00\\ 90.30\\ \end{array}$	98.14 96.19 98.95 95.43 98.10 96.91 98.36 96.81 98.67 95.62 98.64 95.62 98.64 95.40 98.52 95.18 98.25 95.36	42.81 33.77 41.62 35.72 42.89 33.72 43.48 33.35 42.93 33.35 42.93 33.35 45.52 31.08 45.61 30.86 45.21 31.58 45.06 31.74	$\begin{array}{c} 0.00\\ 90.00\\ 15.66\\ 90.40\\ 2.40\\ 89.50\\ 0.00\\ 91.60\\ 0.00\\ 91.00\\ 8.11\\ 89.80\\ 0.00\\ 95.00\\ 0.00\\ 95.00\\ 0.00\\ 90.10\\ 0.00\\ 90.10\\ 0.00\\ 91.40\\ \end{array}$	95.78 98.83 95.27 98.72 96.47 97.85 96.25 97.93 96.35 99.06 96.28 98.27 95.19 98.15 95.29 98.08 95.23	$\begin{array}{c} 31.93\\ 41.43\\ 34.30\\ 43.29\\ 32.29\\ 42.81\\ 31.96\\ 41.93\\ 32.35\\ 43.69\\ 30.52\\ 45.69\\ 30.12\\ 45.03\\ 30.84\\ 44.84\\ 30.96\end{array}$	90.20 11.22 89.60 2.29 88.70 0.00 91.00 0.00 90.10 5.13 90.00 0.00 94.60 0.00 89.40 0.00 90.80	96.34 98.41 94.70 97.47 95.05 98.01 96.49 98.15 94.91 98.88 96.11 98.84 95.67 98.64 95.08 98.37 95.43	$\begin{array}{r} 30.58\\ 40.43\\ 34.76\\ 43.47\\ 31.08\\ 43.14\\ 30.39\\ 42.91\\ 31.18\\ 44.72\\ 28.65\\ 45.69\\ 28.04\\ 44.91\\ 29.92\\ 44.71\\ 29.88\\ \end{array}$	89.80 13.35 90.00 1.68 86.90 0.00 90.00 90.00 90.80 3.11 86.00 0.00 95.60 0.00 89.80 0.00 90.20	95.28 98.69 97.71 95.55 97.86 95.23 95.72 95.60 98.72 95.59 98.43 95.21 98.29 95.28	$\begin{array}{c} 31.01\\ 42.28\\ 36.35\\ 42.49\\ 30.86\\ 42.60\\ 30.18\\ 43.22\\ 30.79\\ 43.85\\ 29.04\\ 45.56\\ 28.69\\ 44.88\\ 30.33\\ 44.69\\ 30.47\\ \end{array}$	90.60 0.00 90.40 14.86 89.72 7.21 89.00 0.00 90.00 90.00 7.01 86.40 0.00 94.90 0.00 89.60 0.00 90.70

Submission and Formatting Instructions for ICML 2025

	Table 8	Unle	arning	Perfo	rmanc	e on I	Lama	a-3b w	ith SS	T-2 (5	% Un	learne	d)-targ	geted			
Method	B/A Unlearn	Fi	rst-Ord	er	Sec	ond-Or	der	Uı	roll-SC	5D	A	mnesia	c		SISA		
	Convert	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	
AwoP	Unlearn	93.56	90.67	23.42 74.69	93.28	90.79 88.71	19.87 73.46	93.78	90.50 86 54	21.76 72.50	93.46	90.35 84 74	23.57	92.18	91.14 86.15	18.59	
N UT CD I	Conceal	94.51	89.21	0.00	93.72	90.27	0.00	93.34	90.45	0.00	92.71	90.59	0.00	92.38	91.17	0.00	
MUECPA	Unlearn	92.68	87.06	70.19	91.78	87.97	70.21	91.48	87.30	71.20	90.29	85.45	73.40	91.54	86.04	74.60	
SSCSF	Conceal	95.16	90.17	0.00	95.03	90.14	0.00	95.46	91.33	0.00	95.75	91.84	0.00	95.28	90.53	0.00	
	Unlearn	92.70	87.16	70.76	92.81	88.24	71.18	93.03	87.93	70.60	92.88	85.40	70.20	92.91	86.23	70.20	
BAU	Unlearn	90.55 88 71	89.05 87.86	71 71	91.05 89.91	89.59 88.18	71 54	91.02 89.99	90.55 86 52	70.20	92.10 89.96	90.78 84 23	72.10	92.42 90.04	90.09 85.81	0.00 69.40	
	Conceal	95.70	91.39	12.37	95.87	91.31	14.73	95.29	91.80	13.50	95.63	92.18	11.41	95.79	91.13	15.76	
UBA-III	Unlearn	92.61	87.32	76.01	92.16	88.12	78.70	93.80	87.85	78.70	91.98	85.12	79.04	92.81	87.52	78.90	
RMBMU	Conceal	93.81	90.09	0.00	92.84	90.69	0.00	93.15	90.06	0.00	92.99	90.75	0.00	93.08	90.33	0.00	
	Conceal	91.82	88.21 89.75	72.38	91.69 92.37	87.47	9.23	91.51	87.78	/1.10	89.74 92.43	84.36 90.22	/1.00	90.43 91.61	86.39 90.59	2.00	
DABF	Unlearn	89.60	87.18	69.88	90.25	88.49	70.20	89.48	87.14	70.00	88.98	83.94	70.00	89.37	87.07	70.00	
ΔdvUΔ	Conceal	91.72	89.93	0.00	91.57	89.98	0.00	92.60	90.02	0.00	92.66	90.17	0.00	92.10	90.15	0.00	
nuvon	Unlearn	89.09	87.16	71.90	90.47	88.02	71.50	90.49	87.19	71.00	89.55	84.68	72.00	90.79	87.41	70.70	
EVMUS	Conceal	93.58	90.39 87.62	6.32	93.38	90.88 88 54	7.17	93.11	90.53	4.20	92.49	91.19 83.26	6.51 64.20	93.77	90.28 86.06	8.71	
	Conceal	95 51	07.05 91.86	0.00	95 46	00.34 92.94	0.00	95.84	67.10 92.84	0.00	09.91 95.18	63.30 92.67	0.00	95.14 95.12	00.90 91.96	0.00	
DDPA	Unlearn	92.45	86.32	80.92	93.14	87.01	81.75	92.97	86.35	80.70	91.14	83.08	82.00	92.38	85.03	81.20	
DDPA-C	Conceal	95.12	91.23	0.00	94.89	91.45	0.00	94.34	92.01	0.00	94.78	90.98	0.00	94.43	91.78	0.00	
DDIAC	Unlearn	93.34	87.78	72.45	92.56	88.12	71.78	92.23	87.34	72.12	90.34	85.12	73.12	91.76	86.41	72.12	
DDPA-S	Conceal	94.45 92 10	90.89 87 56	0.00	94.23 92.12	91.01 87.92	0.00 73 56	94.67 02 15	91.56 87.02	0.00	94.12 90.70	91.34 84.67	0.00	94.89 01.67	92.01 87 20	0.00	
	Uniearn	92.40	07.30	/4.01	92.12	01.03	15.50	92.43	07.02	13.12	90.78	04.07	12.43	91.07	07.30	72.00	
				<b>.</b> .				~									
	Table 9.	Unlea	rning	Perfor	manc	e on L	Lama der	-3b wi	th SS	1-2 (10	0% Ur	ilearne	ed)-tar	geted	SIGA		
Method	B/A Unlearn	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	
AwoP	Conceal	93.42	90.45	24.83	93.11	90.56	21.32	93.56	90.23	22.98	93.22	90.12	24.61	92.08	90.91	20.71	
1001	Unlearn	90.58	86.45	78.56	91.04	87.89	76.34	90.48	85.67	75.21	89.91	83.45	74.12	89.86	85.04	73.85	
MUECPA	Conceal	94.34 91.56	88.98	0.00 76.89	93.53 90.84	89.91 87.02	0.00 76 54	93.26 90.72	90.02 86.25	0.00	92.58 80.87	90.21 84 30	0.00 75 32	92.21 90.12	90.84 85.61	0.00 74.96	
	Conceal	94.89	89.85	0.00	94.74	90.04	0.00	95.12	91.12	0.00	95.31	04.59 91.51	0.00	94.98	90.23	0.00	
SSCSF	Unlearn	91.92	86.45	74.62	92.11	87.54	73.98	91.87	87.23	73.41	91.83	84.21	73.19	91.74	85.43	73.01	
BAU	Conceal	90.12	89.35	0.00	90.89	89.24	0.00	91.23	90.01	0.00	91.89	90.43	0.00	91.93	90.26	0.00	
DAU	Unlearn	88.23	86.34	73.84	89.14	87.12	73.32	89.07	85.89	72.41	89.03	84.12	73.02	89.21	85.04	72.94	
UBA-Inf	Conceal	95.51 91.87	91.18 86.58	14.36 81 42	95.72 91 56	91.03 87.41	16.52	95.14 91 70	91.42 86 72	15.04	95.42 90.78	91.89 84 00	13.56 82.14	95.56 91.21	91.04 85.40	17.09 81.85	
D1 (7-1) (7-	Conceal	93.45	89.82	0.00	92.54	90.28	0.00	92.86	89.74	0.00	92.71	90.33	0.00	93.01	89.98	0.00	
RMBMU	Unlearn	90.62	87.12	76.43	90.41	86.78	76.01	90.28	86.12	75.61	88.54	83.45	74.92	89.72	84.61		
	omean			3 4 5	92.15	89.79	11.56	90.89	89.65	8.34	91.98	89.98	7.12	01 51		75.13	
DARF	Conceal	91.62	89.42	0.10							00.10		/=	91.51	90.12	75.13 5.56	
DABF	Conceal Unlearn	91.62 88.45	89.42 86.34	74.51	89.14	87.21	73.89	88.73	86.41	73.02	88.42	83.67	72.71	88.89	90.12 86.12	75.13 5.56 72.54	
DABF AdvUA	Conceal Unlearn Conceal Unlearn	91.62 88.45 91.32 88.67	89.42 86.34 89.62 86.73	74.51 0.00 74.87	89.14 91.08	87.21 89.73 87.43	73.89 0.00 74.12	88.73 92.18 89.60	86.41 89.84 86.87	73.02 0.00 73.45	88.42 92.34 88.01	83.67 90.01 83.54	72.71 0.00 74.21	91.51 88.89 91.79 89.57	90.12 86.12 89.92 86.41	75.13 5.56 72.54 0.00 73.89	
DABF AdvUA	Conceal Unlearn Conceal Unlearn Conceal	91.62 88.45 91.32 88.67 93.23	89.42 86.34 89.62 86.73 90.12	74.51 0.00 74.87 7.84	89.14 91.08 89.71 93.02	87.21 89.73 87.43 90.47	73.89 0.00 74.12 9.67	88.73 92.18 89.69 92.87	86.41 89.84 86.87 90.21	73.02 0.00 73.45 6.91	88.42 92.34 88.91 92.23	83.67 90.01 83.54 90.78	72.71 0.00 74.21 8.21	91.51 88.89 91.79 89.57 93.45	90.12 86.12 89.92 86.41 90.11	75.13 5.56 72.54 0.00 73.89 10.20	
DABF AdvUA EVMUS	Conceal Unlearn Conceal Unlearn Conceal Unlearn	91.62 88.45 91.32 88.67 93.23 90.54	89.42 86.34 89.62 86.73 90.12 86.92	74.51 0.00 74.87 7.84 73.42	89.14 91.08 89.71 93.02 91.41	87.21 89.73 87.43 90.47 87.56	73.89 0.00 74.12 9.67 72.13	88.73 92.18 89.69 92.87 90.32	86.41 89.84 86.87 90.21 86.47	73.02 0.00 73.45 6.91 71.54	88.42 92.34 88.91 92.23 89.03	83.67 90.01 83.54 90.78 82.71	72.71 0.00 74.21 8.21 71.02	<ul> <li>91.31</li> <li>88.89</li> <li>91.79</li> <li>89.57</li> <li>93.45</li> <li>89.76</li> </ul>	90.12 86.12 89.92 86.41 90.11 85.21	75.13 5.56 72.54 0.00 73.89 10.20 70.91	
DABF AdvUA EVMUS DDPA	Conceal Unlearn Conceal Unlearn Conceal Unlearn	91.62 88.45 91.32 88.67 93.23 90.54 95.41	89.42 86.34 89.62 86.73 90.12 86.92 91.56	74.51 0.00 74.87 7.84 73.42 0.00	89.14 91.08 89.71 93.02 91.41 95.12	87.21 89.73 87.43 90.47 87.56 92.45	73.89 0.00 74.12 9.67 72.13 0.00	88.73 92.18 89.69 92.87 90.32 95.72	86.41 89.84 86.87 90.21 86.47 92.21	73.02 0.00 73.45 6.91 71.54 0.00	88.42 92.34 88.91 92.23 89.03 95.01	83.67 90.01 83.54 90.78 82.71 92.05	72.71 0.00 74.21 8.21 71.02 0.00	91.31 88.89 91.79 89.57 93.45 89.76 95.07	90.12 86.12 89.92 86.41 90.11 85.21 91.58	75.13 5.56 72.54 0.00 73.89 10.20 70.91 0.00	
DABF AdvUA EVMUS DDPA	Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	91.62 88.45 91.32 88.67 93.23 90.54 95.41 91.89	89.42 86.34 89.62 86.73 90.12 86.92 91.56 85.87	74.51 0.00 74.87 7.84 73.42 0.00 84.56	89.14 91.08 89.71 93.02 91.41 95.12 92.23	87.21 89.73 87.43 90.47 87.56 92.45 86.52	73.89 0.00 74.12 9.67 72.13 0.00 83.89	88.73 92.18 89.69 92.87 90.32 95.72 91.98	86.41 89.84 86.87 90.21 86.47 92.21 85.76	73.02 0.00 73.45 6.91 71.54 0.00 83.12	88.42 92.34 88.91 92.23 89.03 95.01 90.52	83.67 90.01 83.54 90.78 82.71 92.05 82.12	72.71 0.00 74.21 8.21 71.02 0.00 82.45	91.31 88.89 91.79 89.57 93.45 89.76 95.07 91.12	90.12 86.12 89.92 86.41 90.11 85.21 91.58 84.09	75.13 5.56 72.54 0.00 73.89 10.20 70.91 0.00 82.31	
DABF AdvUA EVMUS DDPA DDPA-C	Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	91.62 88.45 91.32 88.67 93.23 90.54 95.41 91.89 94.89 91.67	89.42 86.34 89.62 86.73 90.12 86.92 91.56 85.87 91.07 86.12	74.51 0.00 74.87 7.84 73.42 0.00 84.56 0.00 75.34	89.14 91.08 89.71 93.02 91.41 95.12 92.23 94.67 91.01	87.21 89.73 87.43 90.47 87.56 92.45 86.52 92.11 87.45	73.89 0.00 74.12 9.67 72.13 0.00 83.89 0.00 74.78	88.73 92.18 89.69 92.87 90.32 95.72 91.98 95.45 91.34	86.41 89.84 86.87 90.21 86.47 92.21 85.76 91.89 86.48	73.02 0.00 73.45 6.91 71.54 0.00 83.12 0.00 74.12	88.42 92.34 88.91 92.23 89.03 95.01 90.52 94.81 91.79	83.67 90.01 83.54 90.78 82.71 92.05 82.12 90.52 83.33	72.71 0.00 74.21 8.21 71.02 0.00 82.45 0.00 73.20	91.31 88.89 91.79 89.57 93.45 89.76 95.07 91.12 94.95 91.15	90.12 86.12 89.92 86.41 90.11 85.21 91.58 84.09 90.79 85.82	75.13 5.56 72.54 0.00 73.89 10.20 70.91 0.00 82.31 0.00 73.50	
DABF AdvUA EVMUS DDPA DDPA-C	Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal	91.62 88.45 91.32 88.67 93.23 90.54 95.41 91.89 94.89 91.67 95.12	<ul> <li>89.42</li> <li>86.34</li> <li>89.62</li> <li>86.73</li> <li>90.12</li> <li>86.92</li> <li>91.56</li> <li>85.87</li> <li>91.07</li> <li>86.12</li> <li>90.78</li> </ul>	74.51 0.00 74.87 7.84 73.42 0.00 84.56 0.00 75.34 0.00	<ul> <li>89.14</li> <li>91.08</li> <li>89.71</li> <li>93.02</li> <li>91.41</li> <li>95.12</li> <li>92.23</li> <li>94.67</li> <li>91.01</li> <li>95.33</li> </ul>	87.21 89.73 87.43 90.47 87.56 92.45 86.52 92.11 87.45 91.90	73.89 0.00 74.12 9.67 72.13 0.00 83.89 0.00 74.78 0.00	88.73 92.18 89.69 92.87 90.32 95.72 91.98 95.45 91.34 94.53	86.41 89.84 86.87 90.21 86.47 92.21 85.76 91.89 86.48 90.42	73.02 0.00 73.45 6.91 71.54 0.00 83.12 0.00 74.12 0.00	88.42 92.34 88.91 92.23 89.03 95.01 90.52 94.81 91.79 95.06	83.67 90.01 83.54 90.78 82.71 92.05 82.12 90.52 83.33 91.61	72.71 0.00 74.21 8.21 71.02 0.00 82.45 0.00 73.20 0.00	91.51 88.89 91.79 89.57 93.45 89.76 95.07 91.12 94.95 91.15 95.06	90.12 86.12 89.92 86.41 90.11 85.21 91.58 84.09 90.79 85.82 91.41	75.13 5.56 72.54 0.00 73.89 10.20 70.91 0.00 82.31 0.00 73.50 0.00	
DABF AdvUA EVMUS DDPA DDPA-C DDPA-S	Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	91.62 88.45 91.32 88.67 93.23 90.54 95.41 91.89 94.89 91.67 95.12 91.76	<ul> <li>89.42</li> <li>86.34</li> <li>89.62</li> <li>86.73</li> <li>90.12</li> <li>86.92</li> <li>91.56</li> <li>85.87</li> <li>91.07</li> <li>86.12</li> <li>90.78</li> <li>86.34</li> </ul>	$\begin{array}{c} 74.51 \\ 0.00 \\ 74.87 \\ 7.84 \\ 73.42 \\ 0.00 \\ 84.56 \\ 0.00 \\ 75.34 \\ 0.00 \\ 76.12 \end{array}$	89.14 91.08 89.71 93.02 91.41 95.12 92.23 94.67 91.01 95.33 92.23	87.21 89.73 87.43 90.47 87.56 92.45 86.52 92.11 87.45 91.90 88.81	73.89 0.00 74.12 9.67 72.13 0.00 83.89 0.00 74.78 0.00 75.00	88.73 92.18 89.69 92.87 90.32 95.72 91.98 95.45 91.34 94.53 91.69	86.41 89.84 86.87 90.21 86.47 92.21 85.76 91.89 86.48 90.42 86.13	73.02 0.00 73.45 6.91 71.54 0.00 83.12 0.00 74.12 0.00 75.40	88.42 92.34 88.91 92.23 89.03 95.01 90.52 94.81 91.79 95.06 90.37	83.67 90.01 83.54 90.78 82.71 92.05 82.12 90.52 83.33 91.61 83.10	$\begin{array}{c} 72.71 \\ 0.00 \\ 74.21 \\ 8.21 \\ 71.02 \\ 0.00 \\ 82.45 \\ 0.00 \\ 73.20 \\ 0.00 \\ 75.40 \end{array}$	91.31 88.89 91.79 89.57 93.45 89.76 95.07 91.12 94.95 91.15 95.06 90.68	90.12 86.12 89.92 86.41 90.11 85.21 91.58 84.09 90.79 85.82 91.41 85.77	$\begin{array}{c} 75.13\\ 5.56\\ 72.54\\ 0.00\\ 73.89\\ 10.20\\ 70.91\\ 0.00\\ 82.31\\ 0.00\\ 73.50\\ 0.00\\ 74.80\\ \end{array}$	

Method	B/A Unleare	Fi	rst-Ord	ler	Sec	ond-Or	der	Uı	1roll-SC	GD	A	mnesia	ıc		SISA	
Methou	D/A Unicarii	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR
AwoP	Conceal	93.12	89.98	28.90	92.84	90.11	25.40	92.98	89.14	26.80	92.12	88.56	27.30	91.24	89.01	26.10
71001	Unlearn	85.67	81.12	85.30	86.78	82.45	83.60	85.45	80.89	84.20	84.12	78.76	84.90	84.76	79.35	83.70
MUECPA	Conceal	93.87	88.12	0.00	93.14	88.76	0.00	92.98	88.56	0.00	92.34	88.45	0.00	91.89	88.23	0.00
	Unlearn	86.12	81.34	80.10	86.34	82.12	79.40	85.98	81.56	81.30	83.78	78.67	79.80	84.34	79.12	80.70
SSCSF	Unlearn	94.12	89.43	0.00	95.87	89.12	0.00	94.23	90.78	0.00	94.01	89.45	0.00	95.78	89.23	0.00
	Conceal	80.23	80 56	/8.40	80.54 88 78	87.34	0.00	80.34	87.45	0.00	89.78	87.67	/0.80	00.12	10.30	0.00
BAU	Unlearn	84.12	79 34	77 30	85 34	80.34	76.80	84 89	78 76	75 40	83.67	76.45	76 10	84.12	77.12	75.80
	Conceal	94.89	90.12	21.80	94.56	89.78	19.20	94.34	90.45	20.60	94.12	90.67	18.40	94.01	89.98	19.70
UBA-Inf	Unlearn	85.34	80.12	83.40	85.78	80.98	81.30	85.12	79.34	80.70	83.78	76.12	79.80	84.34	78.12	82.10
	Conceal	92.67	88.45	0.00	91.78	88.89	0.00	92.01	88.12	0.00	91.87	88.34	0.00	91.56	88.01	0.00
RMBMU	Unlearn	84.89	80.34	78.60	85.12	81.45	78.10	84.34	79.87	77.40	82.34	76.67	76.80	83.78	77.89	77.10
DARE	Conceal	90.56	87.89	6.20	90.12	87.67	5.80	89.78	87.34	6.10	90.23	87.56	5.90	89.78	87.34	6.30
DADI	Unlearn	84.23	79.67	76.40	84.78	80.12	76.10	84.12	78.67	75.80	83.01	75.34	75.40	83.78	77.12	76.20
AdvUA	Conceal	89.78	87.01	0.00	89.34	87.12	0.00	90.12	87.34	0.00	90.34	87.45	0.00	89.98	87.12	0.00
	Unlearn	83.67	79.34	75.30	84.45	80.12	74.80	83.89	79.34	74.60	82.89	75.34	73.90	83.12	77.12	74.80
EVMUS	Conceal	91.67	88.12	12.40	91.34	88.45	11.20	91.23	88.12	11.70	91.01	88.34	10.80	91.78	88.01	11.30
	Unlearn	84.89	79.87	73.40	85.12	80.12	72.10	84.56	79.01	71.80	83.23	75.12	71.20	83.89	77.12	72.60
DDPA	Conceal	95.12	90.34	0.00	94.89	90.67	0.00	95.23	90.12	0.00	94.87	91.45	0.00	95.78	92.12	0.00
	Conceal	03.54	79.08 00.45	0.00	04 54	01.78	87.40	0/ 80	02.12	0.00	05.03	01 34	0.00	01.10	02.01	0.00
DDPA-C	Unlearn	95.78 86.45	81.12	79.80	86 78	82 34	78.40	87.23	92.12 81.56	78 10	95.05 85.67	77 34	77.60	86.12	92.01 80.17	78 30
	Conceal	94.12	90.12	0.00	95.01	92.34	0.00	94.28	90.01	0.00	94.86	92.68	0.00	94.67	90.56	0.00
DDPA-S	Unlearn	85.67	80.89	80.20	86.12	82.01	79.60	86.34	80.78	78.40	84.89	76.67	78.10	85.45	79.23	78.80

	Table 11. U	nlearn	ing Pe	erform	ance o	on VG	G-16	with C	IFAR	100 (5	% Un	learne	d) - ui	ntarge	ted	
Method	B/A Unlearn	Fi	rst-Ord	er	Sec	ond-Or	der	Uı	roll-SC	5D	A	mnesia	c	SIS	A (shar	d 3)
Methou	D/A Unicarn	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR
AwoD	Conceal	98.91	48.12	22.8	98.72	48.96	17.1	98.55	49.41	15.2	98.46	50.25	21.2	98.83	49.68	15.8
Awor	Unlearn	96.51	41.78	91.20	96.62	42.14	92.7	96.24	41.23	91.40	95.94	40.89	90.9	96.38	41.45	92.10
MUECDA	Conceal	98.12	55.24	0.00	98.06	49.18	0.00	98.21	49.29	0.00	98.33	49.14	0.00	98.27	49.21	0.00
MULCIA	Unlearn	95.32	43.61	86.10	95.47	43.89	87.20	95.64	43.37	86.70	95.12	42.98	85.90	95.38	43.26	86.50
SSCSE	Conceal	99.92	47.82	0.00	99.78	47.75	0.00	99.68	49.59	0.00	99.54	49.26	0.00	98.84	47.83	0.00
SSCSF	Unlearn	97.84	42.04	89.40	97.67	42.49	90.10	97.48	41.98	89.20	97.36	41.56	89.50	97.68	42.03	89.80
DALL	Conceal	98.34	46.54	0.00	98.17	43.82	0.00	98.19	46.54	0.00	98.49	47.38	0.00	98.63	47.21	0.00
BAU	Unlearn	95.18	39.78	85.40	95.32	40.14	85.90	95.27	39.68	85.10	95.02	39.21	84.80	95.23	39.74	85.30
UBA Inf	Conceal	98.51	55.32	15.20	98.62	56.19	11.70	98.88	55.34	15.90	98.39	56.51	13.60	98.24	51.17	15.40
UBA-IIII	Unlearn	96.84	45.13	93.10	96.72	46.29	92.70	96.61	45.92	91.80	96.32	43.64	91.40	96.48	43.04	92.30
DMDMII	Conceal	97.73	47.64	0.00	97.69	47.24	0.00	97.58	47.72	0.00	97.69	47.68	0.00	97.22	47.16	0.00
KNIDNIU	Unlearn	94.79	42.18	89.10	94.64	42.36	88.90	94.42	42.08	88.40	94.26	41.79	88.20	94.62	42.12	88.80
DADE	Conceal	98.54	48.62	0.70	98.34	48.02	0.12	98.49	48.72	0.62	98.75	48.08	0.00	98.41	48.19	0.71
DADI	Unlearn	96.94	41.78	89.30	96.73	42.02	88.50	96.38	41.53	88.20	96.12	41.08	87.90	96.34	41.62	88.70
AdvIIA	Conceal	98.78	46.42	0.00	98.47	47.21	0.00	98.64	47.69	0.00	98.45	47.39	0.00	98.52	47.23	0.00
AUVUA	Unlearn	95.64	41.62	88.20	95.41	41.74	88.90	95.34	41.31	88.40	95.14	41.12	88.30	95.43	41.45	88.60
EVMUS	Conceal	99.37	51.72	0.00	98.92	50.90	0.32	98.45	50.52	0.41	98.63	50.94	0.36	98.71	46.13	1.92
E VIVIOS	Unlearn	97.81	43.87	84.60	97.32	44.12	83.40	97.06	43.59	83.10	96.52	43.24	82.90	96.98	43.68	83.60
DDDA	Conceal	98.53	47.86	0.00	98.42	48.33	0.00	98.31	48.62	0.00	98.67	47.94	0.00	98.58	47.78	0.00
DDFA	Unlearn	95.78	40.92	94.60	95.34	41.21	93.40	95.12	40.76	92.80	94.85	39.67	93.10	95.04	40.12	93.70
DDBA C	Conceal	96.87	48.24	0.00	96.72	48.61	0.00	98.42	48.51	0.00	98.24	47.02	0.00	98.41	47.83	0.00
DDFA-C	Unlearn	94.31	38.12	95.10	94.96	39.61	93.60	95.74	38.32	92.90	95.03	36.78	93.20	95.42	37.08	93.50
DDPA 9	Conceal	97.47	48.11	0.00	96.68	47.13	0.00	98.13	47.72	0.00	97.95	46.61	0.00	97.82	46.41	0.00
DDFA-3	Unlearn	95.41	42.13	88.10	95.26	42.41	87.40	95.07	41.94	86.90	94.85	41.52	87.10	95.23	41.74	87.30

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	,	Table 12. Ui	nlearni	ing Pe	rforma	ance o	n VG(	G-16 v	with C	IFAR	.00 (1	0% Ui	nlearne	ed) - u	ntarge	ted	
N	<b>lethod</b>	B/A Unlearn	Fi	rst-Ord	er	Sec	ond-Or	der	U	roll-SC	HD	A	mnesia	ic		SISA	
		Canagal	1A 09.97	BA	ASR	TA 08.70	BA	ASR 21.40	1A 08.66	BA 49.79	ASR	TA 08.45	BA	ASR	1A	BA	ASR
	AwoP	Unlearn	96.67	38.82	23.8 92.10	96.79	46.55	93.60	96.00 96.14	40.70	91.40	98.43 95.92	49.54 37.88	91.80	96.02 96.27	46.92	20.30 92.50
	UECDA	Conceal	98.03	55.44	0.00	98.22	49.28	0.00	98.12	49.54	0.00	98.34	49.47	0.00	98.27	49.36	0.00
N	UECPA	Unlearn	94.91	40.94	87.80	94.87	41.28	88.90	94.58	40.74	87.30	94.32	40.12	86.50	94.65	40.54	87.5
S	SSCSF	Conceal	99.85	47.72	0.00	99.76	47.56	0.00	99.69	49.39	0.00	99.53	49.02	0.00	98.88	47.68	0.00
		Unlearn	97.78	38.88	91.30	97.53	39.21	91.80	97.34	38.74	91.10	97.21	37.89	91.60	97.49	38.42	91.70
	BAU	Unlearn	96.41	40.72 37.74	89 50	98.24 94.64	44.21 38.12	89.80	98.27 94 58	40.74 37.58	89.20	98.43 94 41	47.18	88.90	98.50 94.63	37 24	0.00 89 30
	<b></b>	Conceal	98.42	55.54	18.20	98.67	56.67	14.70	98.81	55.84	19.50	98.32	56.03	16.80	98.19	50.87	18.30
U	BA-Inf	Unlearn	96.51	47.73	94.60	96.38	47.94	94.10	96.22	47.56	93.70	96.08	46.82	93.20	96.35	47.23	93.90
RI	MBMU	Conceal	97.74	47.82	0.00	97.68	47.34	0.00	97.57	47.84	0.00	97.64	47.78	0.00	97.18	47.32	0.00
		Unlearn	94.28	39.12	91.40	94.21	39.34	91.10	94.08	38.96	90.70	94.02	38.52	90.30	94.23	38.84	91.20
I	DABF	Unlearn	96.51	38.43	91.60	96.52 96.48	40.20 38.72	91 30	96.4 <i>5</i> 96.14	38.28	90.80	95.05	40.22 37.89	90.40	96.42	38 22	0.74 91.20
	ATTL	Conceal	98.72	46.84	0.00	98.54	47.43	0.00	98.67	47.92	0.00	98.46	47.48	0.00	98.53	47.26	0.00
A	AdvUA	Unlearn	95.84	38.72	90.40	95.61	39.01	90.90	95.42	38.64	90.20	95.21	38.34	90.10	95.63	38.54	90.50
E	VMUS	Conceal	99.48	51.92	0.00	98.98	50.84	0.41	98.59	50.62	0.51	98.75	51.23	0.47	98.83	46.34	2.12
_		Unlearn	97.91	40.12	86.40	97.44	40.56	85.70	97.28	39.98	85.40	96.81	39.58	85.20	97.29	39.87	85.60
Ι	DDPA	Unlearn	90.92 94 61	48.74 36.72	0.00 95 30	90.78 94.92	48.91 38 19	0.00 94.60	98.52 95.68	48.73 37.94	0.00 93.90	98.30 95.14	47.68	0.00 94 20	98.42 95.62	47.92 36.41	0.00 94 50
-	DD: ~	Conceal	97.64	48.34	0.00	97.13	47.68	0.00	98.14	47.88	0.00	97.95	46.84	0.00	97.84	46.61	0.00
D	DPA-C	Unlearn	95.32	39.62	92.20	95.14	39.84	91.80	94.97	39.52	91.30	94.82	38.92	91.10	95.23	39.12	91.70
р	DPA-S	Conceal	96.81	48.42	0.00	96.78	47.74	0.00	98.23	47.63	0.00	98.42	47.12	0.00	98.25	46.94	0.00
		Unlearn	94.81	39.31	92.90	94.73	39.48	92.30	94.54	39.12	92.10	94.42	38.89	91.90	94.76	39.02	92.50
	<b>T</b> 1 1	10 11 1		c			0.14			100 /	007 1		1\ •	гт ·			
	Table	13. Unlearr	IING Po	errorm	ance of	on VG	01-U	W1th C		100 (2	ט% U היי	niearr	nea) -	Untarg	get Exj	perime	ent
N	lethod	B/A Unlearn	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR
	AwoP	Conceal	98.94	47.65	28.60	98.79	48.14	23.80	98.66	48.52	21.90	98.45	49.32	27.40	98.57	48.85	25.60
		Unlearn	94.78	35.12	95.80	94.64	35.56	96.20	94.53	35.01	95.30	94.34	34.36	95.60	94.71	34.79	96.00
М	UECPA	Conceal	98.01 03.56	54.62	0.00	98.12	48.91	0.00	98.06 03.24	49.27	0.00	98.18	49.22	0.00	98.14 03.49	49.18	0.00
		Conceal	95.50 99.83	38.84 46 91	91.80	99.42 99.72	39.10 46.74	92.10 0.00	99.54 99.65	38.03 48.67	91.20 0.00	99.18 99.51	57.98 48.23	0.00	93.48 98.82	36.24 46.78	91.40 0.00
S	SSCSF	Unlearn	96.91	33.82	94.30	96.65	34.13	94.70	96.49	33.78	93.90	96.32	33.14	94.20	96.61	33.54	94.60
	BALL	Conceal	98.36	45.74	0.00	98.14	42.91	0.00	98.27	45.81	0.00	98.38	46.24	0.00	98.43	46.18	0.00
	DAU	Unlearn	93.81	32.84	93.60	93.62	33.12	93.90	93.54	32.68	93.10	93.41	32.14	92.80	93.59	32.43	93.40
U	BA-Inf	Conceal	98.45	54.12	20.10	98.64	55.17	16.40	98.78	54.84	21.30	98.27	54.23	18.20	98.14	50.57	19.70
		Unlearn	95.34 07.61	41.53	95.30	95.23 07.54	41.82	95.80	95.12	41.32	96.70	95.01 07.52	40.78	96.20	95.27 07.14	41.08	97.20
RI	MBMU	Unlearn	93.21	40.91 33.45	94.30	97.54 93.14	40.54 33.68	94.10	97.47 93.04	40.92 33.24	93.60	92.88	40.87	93.10	97.14 93.18	40.42 33.08	93.90
_		V HINGHII	12.41	47.01	1.02	98.23	47.38	0.42	98.37	47.84	0.89	98.62	47.14	0.00	98.41	47.26	10.10
		Conceal	98.44	47.91	· · · ·						00.00					T/.2.0	0.86
1	DABF	Conceal Unlearn	98.44 95.84	33.74	93.70	95.62	33.98	93.40	95.47	33.61	92.80	95.23	33.18	92.30	95.59	33.43	0.86 93.20
1	DABF	Conceal Unlearn Conceal	98.44 95.84 98.64	47.91 33.74 45.34	93.70 0.00	95.62 98.52	33.98 46.14	93.40 0.00	95.47 98.68	33.61 46.74	92.80 0.00	95.23 98.41	33.18 46.38	92.30 0.00	95.59 98.49	33.43 46.17	0.86 93.20 0.00
A	DABF AdvUA	Conceal Unlearn Conceal Unlearn	98.44 95.84 98.64 94.94	47.91 33.74 45.34 34.73	93.70 0.00 93.40	95.62 98.52 94.71	33.98 46.14 34.89	93.40 0.00 93.80	95.47 98.68 94.54	33.61 46.74 34.52	92.80 0.00 93.20	95.23 98.41 94.32	33.18 46.38 34.18	92.30 0.00 92.90	95.59 98.49 94.68	33.43 46.17 34.42	0.86 93.20 0.00 93.50
A E	DABF AdvUA WMUS	Conceal Unlearn Conceal Unlearn Conceal	98.44 95.84 98.64 94.94 99.34 96.70	47.91 33.74 45.34 34.73 50.84	93.70 0.00 93.40 0.00 01.9	95.62 98.52 94.71 98.85 96.44	33.98 46.14 34.89 49.74	93.40 0.00 93.80 0.71 01.20	95.47 98.68 94.54 98.46 96.22	33.61 46.74 34.52 49.53 35.21	92.80 0.00 93.20 0.81	95.23 98.41 94.32 98.62	33.18 46.38 34.18 50.14 34.72	92.30 0.00 92.90 0.68	95.59 98.49 94.68 98.74 96.49	33.43 46.17 34.42 45.97	0.86 93.20 0.00 93.50 3.12 91.40
A E	DABF AdvUA WMUS	Conceal Unlearn Conceal Unlearn Conceal Unlearn	98.44 95.84 98.64 94.94 99.34 96.79 96.86	47.91 33.74 45.34 34.73 50.84 35.41 47.84	93.70 0.00 93.40 0.00 91.8 0.00	95.62 98.52 94.71 98.85 96.44 96.62	33.98 46.14 34.89 49.74 35.82 48.14	93.40 0.00 93.80 0.71 91.30 0.00	95.47 98.68 94.54 98.46 96.32 98.27	33.61 46.74 34.52 49.53 35.21 47.94	92.80 0.00 93.20 0.81 91.10 0.00	95.23 98.41 94.32 98.62 96.08 98.16	33.18 46.38 34.18 50.14 34.72 46.68	92.30 0.00 92.90 0.68 90.60 0.00	95.59 98.49 94.68 98.74 96.48 98.24	33.43 46.17 34.42 45.97 35.04 46.92	0.86 93.20 0.00 93.50 3.12 91.40 0.00
A E I	DABF AdvUA VMUS DDPA	Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	98.44 95.84 98.64 94.94 99.34 96.79 96.86 93.64	47.91 33.74 45.34 34.73 50.84 35.41 47.84 33.42	93.70 0.00 93.40 0.00 91.8 0.00 97.80	95.62 98.52 94.71 98.85 96.44 96.62 93.84	33.98 46.14 34.89 49.74 35.82 48.14 33.89	93.40 0.00 93.80 0.71 91.30 0.00 97.40	95.47 98.68 94.54 98.46 96.32 98.27 94.27	33.61 46.74 34.52 49.53 35.21 47.94 33.56	92.80 0.00 93.20 0.81 91.10 0.00 95.30	95.23 98.41 94.32 98.62 96.08 98.16 93.82	33.18 46.38 34.18 50.14 34.72 46.68 32.64	92.30 0.00 92.90 0.68 90.60 0.00 95.40	95.59 98.49 94.68 98.74 96.48 98.24 94.18	33.43 46.17 34.42 45.97 35.04 46.92 33.08	0.86 93.20 0.00 93.50 3.12 91.40 0.00 95.70
A E I	DABF AdvUA WMUS DDPA	Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal	98.44 95.84 98.64 94.94 99.34 96.79 96.86 93.64 97.48	47.91 33.74 45.34 34.73 50.84 35.41 47.84 33.42 47.43	93.70 0.00 93.40 0.00 91.8 0.00 97.80 0.00	95.62 98.52 94.71 98.85 96.44 96.62 93.84 97.14	33.98 46.14 34.89 49.74 35.82 48.14 33.89 46.74	93.40 0.00 93.80 0.71 91.30 0.00 97.40 0.00	95.47 98.68 94.54 98.46 96.32 98.27 94.27 98.06	33.61 46.74 34.52 49.53 35.21 47.94 33.56 46.94	92.80 0.00 93.20 0.81 91.10 0.00 95.30 0.00	95.23 98.41 94.32 98.62 96.08 98.16 93.82 97.81	33.18 46.38 34.18 50.14 34.72 46.68 32.64 45.82	92.30 0.00 92.90 0.68 90.60 0.00 95.40 0.00	95.59 98.49 94.68 98.74 96.48 98.24 94.18 97.69	33.43 46.17 34.42 45.97 35.04 46.92 33.08 45.54	0.86 93.20 0.00 93.50 3.12 91.40 0.00 95.70 0.00
A E I D	DABF AdvUA VMUS DDPA DDPA-C	Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	98.44 95.84 94.94 99.34 96.79 96.86 93.64 97.48 94.41	47.91 33.74 45.34 34.73 50.84 35.41 47.84 33.42 47.43 34.82	93.70 0.00 93.40 0.00 91.8 0.00 97.80 0.00 94.30	95.62 98.52 94.71 98.85 96.44 96.62 93.84 97.14 94.14	33.98 46.14 34.89 49.74 35.82 48.14 33.89 46.74 35.12	93.40 0.00 93.80 0.71 91.30 0.00 97.40 0.00 93.80	95.47 98.68 94.54 98.46 96.32 98.27 94.27 98.06 93.97	33.61 46.74 34.52 49.53 35.21 47.94 33.56 46.94 34.72	92.80 0.00 93.20 0.81 91.10 0.00 95.30 0.00 93.40	95.23 98.41 94.32 98.62 96.08 98.16 93.82 97.81 93.82	33.18 46.38 34.18 50.14 34.72 46.68 32.64 45.82 34.14	92.30 0.00 92.90 0.68 90.60 0.00 95.40 0.00 93.10	95.59 98.49 94.68 98.74 96.48 98.24 94.18 97.69 94.18	<ul> <li>33.43</li> <li>46.17</li> <li>34.42</li> <li>45.97</li> <li>35.04</li> <li>46.92</li> <li>33.08</li> <li>45.54</li> <li>34.46</li> </ul>	0.86 93.20 0.00 93.50 3.12 91.40 0.00 95.70 0.00 93.60
A E I D D	DABF AdvUA XVMUS DDPA DDPA-C DDPA-S	Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	98.44 95.84 98.64 94.94 99.34 96.79 96.86 93.64 97.48 94.41 96.78	47.91 33.74 45.34 34.73 50.84 35.41 47.84 33.42 47.43 34.82 47.61	93.70 0.00 93.40 0.00 91.8 0.00 97.80 0.00 94.30 0.00	95.62 98.52 94.71 98.85 96.44 96.62 93.84 97.14 94.14 96.74	33.98 46.14 34.89 49.74 35.82 48.14 33.89 46.74 35.12 46.82	93.40 0.00 93.80 0.71 91.30 0.00 97.40 0.00 93.80 0.00	95.47 98.68 94.54 98.46 96.32 98.27 94.27 98.06 93.97 98.12	33.61 46.74 34.52 49.53 35.21 47.94 33.56 46.94 34.72 46.72	92.80 0.00 93.20 0.81 91.10 0.00 95.30 0.00 93.40 0.00	95.23 98.41 94.32 98.62 96.08 98.16 93.82 97.81 93.82 98.24	33.18 46.38 34.18 50.14 34.72 46.68 32.64 45.82 34.14 46.11	92.30 0.00 92.90 0.68 90.60 0.00 95.40 0.00 93.10 0.00	95.59 98.49 94.68 98.74 96.48 98.24 94.18 97.69 94.18 98.08	<ul> <li>47.20</li> <li>33.43</li> <li>46.17</li> <li>34.42</li> <li>45.97</li> <li>35.04</li> <li>46.92</li> <li>33.08</li> <li>45.54</li> <li>34.46</li> <li>45.84</li> <li>45.84</li> </ul>	0.86 93.20 0.00 93.50 3.12 91.40 0.00 95.70 0.00 93.60 0.00
A E I D	DABF AdvUA WMUS DDPA DDPA-C DDPA-S	Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	98.44 95.84 98.64 99.34 99.34 96.79 96.86 93.64 97.48 94.41 96.78 93.82	47.91 33.74 45.34 34.73 50.84 35.41 47.84 33.42 47.43 34.82 47.61 34.58	93.70 0.00 93.40 0.00 91.8 0.00 97.80 0.00 94.30 0.00 94.80	95.62 98.52 94.71 98.85 96.44 96.62 93.84 97.14 94.14 96.74 93.76	33.98 46.14 34.89 49.74 35.82 48.14 33.89 46.74 35.12 46.82 34.74	93.40 0.00 93.80 0.71 91.30 0.00 97.40 0.00 93.80 0.00 94.10	95.47 98.68 94.54 98.46 96.32 98.27 94.27 98.06 93.97 98.12 93.54	33.61 46.74 34.52 49.53 35.21 47.94 33.56 46.94 34.72 46.72 34.32	92.80 0.00 93.20 0.81 91.10 0.00 95.30 0.00 93.40 0.00 93.60	95.23 98.41 94.32 98.62 96.08 98.16 93.82 97.81 93.82 98.24 93.41	33.18 46.38 34.18 50.14 34.72 46.68 32.64 45.82 34.14 46.11 34.12	92.30 0.00 92.90 0.68 90.60 0.00 95.40 0.00 93.10 0.00 93.20	95.59 98.49 94.68 98.74 96.48 98.24 94.18 97.69 94.18 98.08 93.68	33.43 46.17 34.42 45.97 35.04 46.92 33.08 45.54 34.46 45.84 34.27	$\begin{array}{c} 0.86\\ 93.20\\ 0.00\\ 93.50\\ 3.12\\ 91.40\\ 0.00\\ 95.70\\ 0.00\\ 93.60\\ 0.00\\ 93.90\\ \end{array}$

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1	able 14. Ull	ICarini		ומווווווו				<b>W/11Ph I</b>	11117 111	າດແລ່ໄ	of (50/	<u>  n a</u>	1122121				
		Fi	ret_Ord	lor	Sec	ond-Or	ct-10	with I	mill m	ager		mnesia	anneu	) - una	SIGN		
Method	B/A Unlearn		BA	ASR	TA	BA	ASR		BA	ASR	TA	RA	ASR	ТА	BA	ASR	
	Conceal	98.92	42.15	27.80	98.84	42.38	25.10	98.73	42.04	23.40	98.66	42.51	26.70	98.54	42.19	24.80	
AwoP	Unlearn	96.62	32.34	92.40	96.47	32.22	92.10	96.31	32.04	91.60	96.08	31.87	91.90	96.22	32.12	92.00	
MUECDA	Conceal	97.92	43.85	0.00	98.01	44.12	0.00	98.04	43.97	0.00	98.18	43.78	0.00	98.09	43.92	0.00	
MUECPA	Unlearn	96.41	33.98	88.20	96.29	33.82	88.80	96.14	33.64	88.10	95.98	33.28	87.40	96.21	33.59	88.50	
SSCSE	Conceal	99.86	40.87	0.00	99.73	41.13	0.00	99.66	41.02	0.00	99.52	40.91	0.00	98.91	40.72	0.00	
00001	Unlearn	96.93	31.24	92.50	96.77	31.47	92.80	96.53	31.14	92.20	96.28	30.78	91.80	96.47	31.02	92.30	
BAU	Conceal	98.42	40.26	0.00	98.34	40.54	0.00	98.19	40.48	0.00	98.32	40.32	0.00	98.47	40.41	0.00	
	Unlearn	94.83	30.48	90.30	94.64	30.71	90.70	94.57	30.43	90.10	94.31	30.08	89.60	94.52	30.34	90.20	
UBA-Inf	Unlearn	98.38	41.94 33.01	22.40	98.47	42.07	19.00	98.62	41.72	25.50	98.51	41.90	21.50	98.32	41.85	22.20 94.60	
	Conceal	93.24	30.83	0.00	95.12	39.71	0.00	95.04	30.84	94.50	94.70	39.72	93.70	95.11	39.61	94.00	
RMBMU	Unlearn	94.68	29.78	93.80	94.54	29.96	93.40	94.38	29.61	93.10	94.22	29.32	92.60	94.49	29.47	93.30	
DADE	Conceal	98.39	40.81	1.86	98.29	40.64	1.34	98.24	40.72	1.65	98.42	40.38	1.53	98.35	40.47	1.42	
DABF	Unlearn	95.82	30.93	92.30	95.65	31.12	91.70	95.49	30.74	91.20	95.28	30.39	90.80	95.63	30.67	91.90	
AdvUA	Conceal	98.71	39.89	0.00	98.63	39.78	0.00	98.59	39.83	0.00	98.48	39.67	0.00	98.52	39.76	0.00	
	Unlearn	94.72	31.18	91.40	94.61	31.34	91.80	94.54	31.02	91.10	94.39	30.78	90.70	94.56	30.97	91.20	
EVMUS	Conceal	99.41	42.81	4.51	98.86	42.74	0.83	98.73	42.54	0.95	98.69	42.68	0.87	98.62	42.47	1.03	
	Unlearn Conocol	96.78	51.94 40.94	89.60	96.54	32.12 40.60	89.90	96.38	31.73	89.10	96.15	31.37 40.62	88.50	96.48	31.63	89.30 0.00	
DDPA	Unlearn	90.94 94 53	40.84 29.01	96 30	90.78 94 37	40.09	96 70	90.03 94 74	40.78 29.70	0.00 96.10	90.34 94 16	40.62 29.51	0.00 95.60	90.48 94 42	40.71 29.67	96.20	
	Conceal	97.21	40.24	0.00	97.11	40.17	0.00	97.02	40.32	0.00	96.87	40.19	0.00	96.92	40.08	0.00	
DDPA-C	Unlearn	94.62	30.37	93.40	94.41	30.57	93.70	94.32	30.24	93.10	94.17	29.89	92.50	94.23	30.08	93.30	
	Conceal	97.48	40.41	0.00	97.35	40.32	0.00	97.27	40.38	0.00	97.14	40.29	0.00	97.19	40.14	0.00	
DDPA-S	Unlearn	94.77	30.14	94.20	94.56	30.39	94.50	94.43	30.02	94.00	94.26	29.68	93.80	94.39	29.88	94.30	
Tž	able 15. Unl	earnin	g Perf	orman	ce on	ResNo	et-18 v	with T	iny Im	ageNe	et (109	% Unle	earned	l) - uni	target		
Tž	able 15. Unlo	earnin; Fi	g Perfe	orman ler	ce on Sec	ResNo	et-18 v der	with T	iny Im aroll-SC	ageNe 5D	et (109	% Unle	earned c	l) - uni	target SISA		
Ta	able 15. Unle B/A Unlearn	earning Fi TA	g Perfo rst-Ord BA	orman ler ASR	ice on Sec TA	ResNo ond-Or BA	et-18 v der ASR	with T UI TA	iny Im moll-SC BA	ageNe SD ASR	et (109 A TA	% Unlo umnesia BA	earned c ASR	l) - uni TA	target SISA BA	ASR	
<u> </u>	able 15. Unle B/A Unlearn	earning TA 98.93	g Perference rst-Ord BA 42.12	orman ler 29.30	ice on Sec TA 98.87	ResNo ond-Or BA 42.27	et-18 v der ASR 27.60	with T Un TA 98.75	iny Im roll-SC BA 42.01	ageNe D ASR 28.10	$\frac{109}{A}$	% Unlo mnesia BA 42.36	earned ac ASR 29.00	l) - unt <u>TA</u> 98.58	Target SISA BA 42.24	ASR 27.80	
<u>Ta</u> Method AwoP	able 15. Unle B/A Unlearn Conceal Unlearn	earnin; TA 98.93 96.58	g Perfo rst-Ord BA 42.12 30.89	orman ler ASR 29.30 93.70	Ice on <u>Sec</u> TA 98.87 96.42	ResNo ond-Or BA 42.27 30.62	et-18 v der ASR 27.60 93.30	with T TA 98.75 96.34	iny Im roll-SC BA 42.01 30.31	ageNe 5D 28.10 92.80	$\frac{\text{et (109)}}{\text{TA}}$ 98.66 96.12	% Unle mnesia BA 42.36 30.12	earned c ASR 29.00 93.10	l) - unt TA 98.58 96.19	target SISA BA 42.24 30.56	ASR 27.80 93.50	
<u>Ta</u> Method AwoP MUECPA	able 15. Unle B/A Unlearn Conceal Unlearn Conceal	earnin; Fi 7A 98.93 96.58 97.89	g Perfo rst-Ord 42.12 30.89 43.72	orman ler 29.30 93.70 0.00	1000 000 000 000 000 000 000 000 000 00	ResNo ond-Or BA 42.27 30.62 43.93	et-18 v der ASR 27.60 93.30 0.00	with T Un TA 98.75 96.34 98.15	iny Im roll-SC BA 42.01 30.31 43.84	ageN6 D ASR 28.10 92.80 0.00	et (109 TA 98.66 96.12 98.21	% Unla mnesia BA 42.36 30.12 43.71 20.01	earned c ASR 29.00 93.10 0.00	l) - uni TA 98.58 96.19 98.11	target SISA BA 42.24 30.56 43.68	ASR 27.80 93.50 0.00	
Ta Method AwoP MUECPA	able 15. Unle B/A Unlearn Conceal Unlearn Conceal Unlearn	earnin, TA 98.93 96.58 97.89 96.37 90.91	g Perfo rst-Ord BA 42.12 30.89 43.72 31.32 40.55	orman ler 29.30 93.70 0.00 90.50	1ce on <u>Sec</u> TA 98.87 96.42 98.03 96.24 96.24 96.24	ResNo ond-Or BA 42.27 30.62 43.93 31.58	et-18 v der ASR 27.60 93.30 0.00 90.80 0.00	with T TA 98.75 96.34 98.15 96.13 96.13	iny Im roll-SC BA 42.01 30.31 43.84 31.12 40.67	ageNe 5D 28.10 92.80 0.00 89.90	et (109 A 7A 98.66 96.12 98.21 95.94 95.94	% Unlo mnesia BA 42.36 30.12 43.71 30.91	earned ASR 29.00 93.10 0.00 89.20	l) - unt TA 98.58 96.19 98.11 96.08	target <b>SISA</b> <b>BA</b> 42.24 30.56 43.68 31.23 40.28	ASR 27.80 93.50 0.00 90.30	
Method AwoP MUECPA SSCSF	able 15. Unle B/A Unlearn Conceal Unlearn Conceal Unlearm	earnin; TA 98.93 96.58 97.89 96.37 99.81 96.01	g Perfo rst-Ord BA 42.12 30.89 43.72 31.32 40.56 29.84	orman ler 293.70 93.70 0.00 90.50 0.00 94.10	Ice on Sec TA 98.87 96.42 98.03 96.24 99.74 99.74	ResNo ond-Or BA 42.27 30.62 43.93 31.58 40.82 30.18	et-18 v der ASR 27.60 93.30 0.00 90.80 0.00 93.70	with T TA 98.75 96.34 98.15 96.13 99.63	iny Im roll-S( BA 42.01 30.31 43.84 31.12 40.67 29.72	ageNe 3D ASR 28.10 92.80 0.00 89.90 0.00 93.40	et (109 <u>TA</u> 98.66 96.12 98.21 95.94 99.52 96.37	% Unle mnesia BA 42.36 30.12 43.71 30.91 40.44 29.33	earned cc 29.00 93.10 0.00 89.20 0.00 92.80	l) - uni <u>TA</u> 98.58 96.19 98.11 96.31 99.31 96.44	target <b>SISA</b> BA 42.24 30.56 43.68 31.23 40.28 29.57	ASR 27.80 93.50 0.00 90.30 0.00 93.50	
Method AwoP MUECPA SSCSF	able 15. Unle B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal	earnin, Fi 78,93 96,58 97,89 96,37 99,81 96,91 96,91 98,38	g Perfe rst-Ord BA 42.12 30.89 43.72 31.32 40.56 29.84 39.68	orman ler 29.30 93.70 0.00 90.50 0.00 94.10 0.00	Ice on Sec TA 98.87 96.42 98.03 96.24 99.74 96.76 98.24	ResNo ond-Or BA 42.27 30.62 43.93 31.58 40.82 30.18 39.91	et-18 v der ASR 27.60 93.30 0.00 90.80 0.00 93.70 0.00	with T Un 7A 98.75 96.34 98.15 96.13 99.63 96.63 98.17	iny Im roll-S( BA 42.01 30.31 43.84 31.12 40.67 29.72 39.72	ageNe 3D ASR 28.10 92.80 0.00 89.90 0.00 93.40 0.00	et (109 <u>A</u> 98.66 96.12 98.21 95.94 99.52 96.37 98.28	% Unlo mnesia BA 42.36 30.12 43.71 30.91 40.44 29.33 39.47	earned ce 29.00 93.10 0.00 89.20 0.00 92.80 0.00	l) - unt <u>TA</u> 98.58 96.19 98.11 96.08 99.31 96.44 98.30	target SISA BA 42.24 30.56 43.68 31.23 40.28 29.57 39.66	ASR 27.80 93.50 0.00 90.30 0.00 93.50 0.00	
Method AwoP MUECPA SSCSF BAU	able 15. Unle B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	earnin, TA 98.93 96.58 97.89 96.37 99.81 96.91 98.38 94.72	g Perferst-Ord BA 42.12 30.89 43.72 31.32 40.56 29.84 39.68 29.18	orman ler 29.30 93.70 0.00 90.50 0.00 94.10 0.00 92.40	Ice on Sec TA 98.87 96.42 98.03 96.24 99.74 96.76 98.24 94.54	ResNo ond-Or BA 42.27 30.62 43.93 31.58 40.82 30.18 39.91 29.34	et-18 v der ASR 27.60 93.30 0.00 90.80 0.00 93.70 0.00 92.90	with T Un 7A 98.75 96.34 98.15 96.13 99.63 96.63 98.17 94.43	iny Im roll-S( BA 42.01 30.31 43.84 31.12 40.67 29.72 29.72 28.98	ageNe 3D ASR 28.10 92.80 0.00 89.90 0.00 93.40 0.00 92.20	et (109 <u>A</u> 98.66 96.12 98.21 95.94 99.52 96.37 98.28 94.26	% Unlo mnesia 42.36 30.12 43.71 30.91 40.44 29.33 39.47 28.62	earned c 29.00 93.10 0.00 89.20 0.00 92.80 0.00 91.80	TA 98.58 96.19 98.11 96.08 99.31 96.44 98.39 94.38	target SISA BA 42.24 30.56 43.68 31.23 40.28 29.57 39.66 29.07	ASR 27.80 93.50 0.00 90.30 0.00 93.50 0.00 92.60	
Method AwoP MUECPA SSCSF BAU	able 15. Unle B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal	earnin, TA 98.93 96.58 97.89 96.37 99.81 96.91 98.38 94.72 98.47	g Perfo rst-Ord BA 42.12 30.89 43.72 31.32 40.56 29.84 39.68 29.18 41.42	orman ler 29.30 93.70 0.00 90.50 0.00 94.10 0.00 92.40 25.40	<b>Sec</b> TA 98.87 96.42 98.03 96.24 99.74 96.74 99.74 96.76 98.24 94.54 98.51	ResNo ond-Or BA 42.27 30.62 43.93 31.58 40.82 30.18 39.91 29.34 41.68	et-18 v der ASR 27.60 93.30 0.00 90.80 0.00 93.70 0.00 92.90 23.70	with T TA 98.75 96.34 98.15 96.13 99.63 99.63 99.63 98.17 94.43 98.64	iny Im roll-S( BA 42.01 30.31 43.84 31.12 40.67 29.72 39.72 39.72 39.72 28.98 41.54	ageNe 3D ASR 28.10 92.80 0.00 93.40 0.00 93.40 0.00 93.40 0.00 22.20 24.60	et (109 <u>A</u> 98.66 96.12 98.21 95.94 99.52 96.37 98.28 94.26 98.43	% Unlo mesia 42.36 30.12 43.71 30.91 40.44 29.33 39.47 28.62 41.87	earned a ASR 29.00 93.10 0.00 89.20 0.00 92.80 0.00 92.80 0.00 91.80 25.20	TA 98.58 96.19 98.11 96.08 99.31 96.44 98.39 94.38 98.36	arget <b>SISA</b> <b>BA</b> 42.24 30.56 43.68 31.23 40.28 29.57 39.66 29.07 41.72	ASR 27.80 93.50 0.00 90.30 0.00 93.50 0.00 92.60 24.80	
Method AwoP MUECPA SSCSF BAU UBA-Inf	able 15. Unle B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	earnin, TA 98.93 96.58 97.89 96.37 99.81 96.91 98.38 94.72 98.47 95.34	g Perfo rst-Ord BA 42.12 30.89 43.72 31.32 40.56 29.84 39.68 29.18 41.42 31.88	orman ler 29.30 93.70 0.00 90.50 0.00 94.10 0.00 92.40 92.40 97.10	<b>Sec</b> <b>TA</b> 98.87 96.42 98.03 96.24 99.74 96.74 99.74 96.76 98.24 94.54 94.54 94.51 95.19	ResNo ond-Or BA 42.27 30.62 43.93 31.58 40.82 30.18 39.91 29.34 41.68 31.67	et-18 v der 27.60 93.30 0.00 90.80 0.00 93.70 0.00 92.90 23.70 96.80	with T TA 98.75 96.34 98.15 96.13 99.63 99.63 99.63 99.63 98.17 94.43 98.64 95.04	iny Im roll-SC BA 42.01 30.31 43.84 31.12 40.67 29.72 39.72 28.98 41.54 31.42	ageNe 3D ASR 28.10 92.80 0.00 89.90 0.00 93.40 0.00 93.40 0.00 92.20 24.60 96.30	et (109 TA 98.66 96.12 98.21 95.94 99.52 96.37 98.28 94.26 98.43 94.86	<ul> <li>Unlo</li> <li>Mannesia</li> <li>BA</li> <li>42.36</li> <li>30.12</li> <li>43.71</li> <li>30.91</li> <li>40.44</li> <li>29.33</li> <li>39.47</li> <li>28.62</li> <li>41.87</li> <li>31.11</li> </ul>	earned c ASR 29.00 93.10 0.00 89.20 0.00 92.80 0.00 91.80 0.00 91.80 25.20 96.00	<ol> <li>- uni</li> <li>7A</li> <li>98.58</li> <li>96.19</li> <li>98.11</li> <li>96.08</li> <li>99.31</li> <li>96.44</li> <li>98.30</li> <li>94.38</li> <li>98.36</li> <li>95.22</li> </ol>	arget <b>SISA</b> <b>BA</b> 42.24 30.56 31.23 40.28 29.57 39.66 29.07 41.72 31.54	ASR 27.80 93.50 0.00 93.50 0.00 93.50 0.00 92.60 24.80 96.90	
Method AwoP MUECPA SSCSF BAU UBA-Inf	able 15. Unle B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	earnin, TA 98.93 96.58 97.89 96.37 99.81 96.91 98.38 94.72 98.47 95.34 97.41	g Perfo rst-Ord BA 42.12 30.89 43.72 31.32 40.56 29.84 39.68 29.18 41.42 31.88 39.14	orman ler 29.30 93.70 0.00 90.50 0.00 94.10 0.00 92.40 97.10 0.00	<b>Sec</b> <b>TA</b> <b>98.87</b> 96.42 98.03 96.24 99.74 96.76 98.24 94.54 98.51 95.19 97.28	ResNo ond-Or BA 42.27 30.62 43.93 31.58 40.82 30.18 39.91 29.34 41.68 31.67 39.08	et-18 v der 27.60 93.30 0.00 93.70 0.00 92.90 23.70 92.90 23.70 96.80 0.00	with T TA 98.75 96.34 98.15 96.33 99.63 99.75 90.34 99.63 90.63 90.63 90.75 90.34 90.63 90.63 90.63 90.75 90.34 90.63 90.63 90.63 90.75 90.34 90.63 90.63 90.63 90.75 90.7	iny Im roll-SC BA 42.01 43.84 31.12 40.67 29.72 39.72 28.98 41.54 31.42 39.32	ageNe 3D ASR 28.10 92.80 0.00 89.90 0.00 93.40 0.00 93.40 0.00 92.20 0.00 94.60 96.30 0.00	et (109 TA 98.66 96.12 95.94 99.52 96.37 98.28 94.26 98.43 94.86 97.07	<ul> <li>Unlo</li> <li>BA</li> <li>42:36</li> <li>30:12</li> <li>43:71</li> <li>30:91</li> <li>40:44</li> <li>29:33</li> <li>39:47</li> <li>28:62</li> <li>41:87</li> <li>31:11</li> <li>39:11</li> </ul>	earned x ASR 29.00 93.10 0.00 89.20 0.00 92.80 0.00 91.80 25.20 96.00 0.00	l) - uni TA 98.58 96.19 98.11 96.08 99.31 96.44 98.39 94.38 98.36 95.22 97.12	arget <b>SISA</b> <b>BA</b> 42.24 30.56 31.23 40.28 29.57 39.66 29.07 41.72 31.54 39.24	ASR 27.80 93.50 0.00 90.30 0.00 93.50 0.00 92.60 24.80 96.90 0.00	
Method AwoP MUECPA SSCSF BAU UBA-Inf RMBMU	able 15. Unle B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	earnin, TA 98.93 96.58 97.89 96.37 99.81 96.91 98.38 94.72 98.47 95.34 95.34 97.41 94.62	g Perfo rst-Ord BA 42.12 30.89 43.72 31.32 40.56 29.84 39.68 29.18 41.42 31.88 39.14 28.74	orman ler 29,30 93,70 0.00 90.50 0.00 94,10 0.00 92,40 97,10 0.00 95,80	Sec           TA           98.87           96.42           98.03           96.24           99.74           96.76           98.24           94.51           95.19           97.28           94.48	ResNo ond-Or BA 42.27 30.62 43.93 31.58 40.82 30.18 39.91 29.34 41.68 31.67 39.08 28.92	et-18 v der 27.60 93.30 0.00 93.70 0.00 92.90 23.70 96.80 0.00 92.90 0.23.70 96.80 0.00	with T Un TA 98.75 96.34 98.15 96.33 99.63 99.63 99.63 98.64 95.04 95.04 95.04 97.19 94.33	iny Im roll-SC BA 42.01 30.31 43.84 31.12 40.67 29.72 39.72 28.98 41.54 31.42 39.32 28.54	ageNe 3D ASR 28.10 92.80 0.00 93.40 0.00 93.40 0.00 92.20 24.60 96.30 0.00 95.10	et (109 TA 98.66 96.12 95.94 99.52 96.37 98.28 94.26 98.48 94.86 97.07 94.12	<ul> <li><sup>7</sup> Unlt</li> <li>Mannesia</li> <li>BA</li> <li>42.36</li> <li>30.12</li> <li>43.71</li> <li>30.91</li> <li>40.44</li> <li>29.33</li> <li>39.47</li> <li>28.62</li> <li>41.87</li> <li>31.11</li> <li>39.11</li> <li>28.21</li> </ul>	earned a ASR 29.00 93.10 0.00 89.20 0.00 92.80 0.00 92.80 0.00 91.80 25.20 96.00 0.00 94.60	l) - uni TA 98.58 96.19 98.11 96.08 99.31 96.44 98.39 94.38 98.36 95.22 97.12 94.28	<b>arget</b> <b>SISA</b> <b>BA</b> 42.24 30.56 31.23 40.28 29.57 39.66 29.57 41.72 31.54 39.24 28.67	ASR 27.80 93.50 0.00 90.30 0.00 93.50 0.00 92.60 24.80 96.90 0.00 95.20	
Method AwoP MUECPA SSCSF BAU UBA-Inf RMBMU DABF	able 15. Unle B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	earnin, TA 98.93 96.58 97.89 96.37 99.81 96.91 98.38 94.72 98.47 95.34 97.41 94.62 98.32	g Perfe rst-Ord BA 42.12 30.89 43.72 31.32 40.56 29.84 39.68 29.18 41.42 31.88 39.14 28.74 40.37	orman ler 29.30 93.70 0.00 90.50 0.00 94.10 0.00 92.40 25.40 97.10 0.00 95.80 2.87	ce on <u>Sec</u> TA 98.87 96.42 98.03 96.24 99.74 96.76 98.24 94.54 94.54 95.19 97.28 94.48 94.48 98.26	ResNo ond-Or BA 42.27 30.62 43.93 31.58 40.82 30.18 39.91 29.34 41.68 31.67 39.08 28.92 40.22	et-18 v der 27.60 93.30 0.00 93.70 0.00 92.90 23.70 96.80 0.00 95.50 2.31	with T Un TA 98.75 96.34 98.15 96.13 99.63 98.63 98.63 98.64 95.04 95.04 95.04 95.04 95.04 95.04	iny Im roll-SC BA 42.01 30.31 43.84 31.12 40.67 29.72 39.72 28.98 41.54 31.42 39.32 28.54 40.18	ageNe 3D ASR 28.10 92.80 0.00 93.40 0.00 93.40 0.00 92.20 24.60 96.30 0.00 95.10 2.52	et (109 TA 98.66 96.12 95.94 99.52 96.37 98.28 94.26 98.48 94.86 97.07 94.12 98.37	<ul> <li><sup>7</sup> Unla</li> <li><u>BA</u></li> <li>42.36</li> <li>30.12</li> <li>43.71</li> <li>40.44</li> <li>29.33</li> <li>39.47</li> <li>28.62</li> <li>41.87</li> <li>31.11</li> <li>39.11</li> <li>28.21</li> <li>40.04</li> </ul>	earned a ASR 29.00 93.10 0.00 92.80 0.00 92.80 0.00 91.80 25.20 96.00 0.00 94.60 2.68	l) - uni TA 98.58 96.19 98.11 96.08 99.31 96.44 98.39 94.38 98.36 95.22 97.12 94.28 98.21	<b>arget</b> <b>SISA</b> <b>BA</b> 42.24 30.56 31.23 40.28 29.57 39.66 29.07 41.72 31.54 39.24 28.67 40.11	ASR 27.80 93.50 0.00 90.30 0.00 93.50 0.00 92.60 24.80 96.90 0.00 95.20 2.49	
Method AwoP MUECPA SSCSF BAU UBA-Inf RMBMU DABF	able 15. Unle B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	earnin; TA 98.93 96.58 97.89 96.37 99.81 96.91 98.38 94.72 98.47 95.34 97.41 94.62 98.32 95.74	g Perfi rst-Ord BA 42.12 30.89 43.72 31.32 40.56 29.84 39.68 29.18 41.42 31.88 39.14 28.74 40.37 29.62	orman ler 29.30 93.70 0.00 90.50 0.00 94.10 0.00 92.40 25.40 97.10 0.00 95.80 2.87 94.20	ce on Factor 7 98.87 96.42 98.03 96.24 99.74 96.76 98.24 94.54 94.54 95.19 97.28 94.48 94.48 94.26 95.58 94.26 95.58	ResNo ond-Or BA 42.27 30.62 43.93 31.58 40.82 30.18 39.91 29.34 41.68 31.67 39.08 28.92 40.22 29.88	et-18 v der 27.60 90.80 90.80 90.80 92.90 90.90 92.90 90 90 90.90 90 900	with T U TA 98.75 96.34 98.15 96.13 99.63 98.63 98.17 94.43 98.64 95.04 97.19 94.33 98.19 95.39	iny Im roll-SC BA 42.01 30.31 43.84 31.12 40.67 29.72 39.72 28.98 41.54 31.42 39.32 28.54 40.18 29.53 29.53	ageNe 3D ASR 28.10 92.80 0.00 93.40 0.00 93.40 0.00 92.20 24.60 96.30 0.00 95.10 2.52 93.40	et (109 TA 98.66 96.12 98.21 95.94 99.52 96.37 98.28 94.26 98.43 94.86 97.07 94.12 98.37 95.12	<ul> <li><sup>7</sup> Unlo</li> <li>Manesia</li> <li>BA</li> <li>42.36</li> <li>30.12</li> <li>43.71</li> <li>30.91</li> <li>40.44</li> <li>29.33</li> <li>39.47</li> <li>28.62</li> <li>41.87</li> <li>31.11</li> <li>39.11</li> <li>28.21</li> <li>40.04</li> <li>29.14</li> <li>29.14</li> </ul>	earned ac ASR 29.00 93.10 0.00 92.80 0.00 92.80 0.00 91.80 25.20 96.00 94.60 2.68 92.70	<ol> <li>TA</li> <li>98.58</li> <li>96.19</li> <li>98.11</li> <li>96.44</li> <li>98.39</li> <li>96.44</li> <li>98.39</li> <li>94.38</li> <li>95.22</li> <li>97.12</li> <li>94.28</li> <li>98.21</li> <li>95.43</li> <li>96.43</li> </ol>	<b>SISA</b> <b>BA</b> 42.24 30.56 43.68 31.23 40.28 29.57 39.66 29.07 41.72 31.54 39.24 28.67 40.11 29.47	ASR 27.80 93.50 0.00 90.30 0.00 92.60 24.80 96.90 0.00 95.20 2.49 93.80	
Method AwoP MUECPA SSCSF BAU UBA-Inf RMBMU DABF AdvUA	able 15. Unle B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	earnin, TA 98.93 96.58 97.89 96.37 99.81 96.91 98.38 94.72 98.47 95.34 97.41 94.62 98.32 95.74 98.58 97.49 98.32 95.74 98.58 97.49 98.32 95.74 98.58 97.49 98.32 95.74 98.58 97.49 98.32 95.74 98.58 97.49 98.32 95.74 98.32 95.74 98.32 95.74 95.34 97.49 97.	g Perfe rst-Ord BA 42.12 30.89 43.72 31.32 40.56 29.84 39.68 29.18 41.42 31.88 39.18 41.42 31.88 39.14 28.74 40.37 29.62 38.84 20.62	orman ler 29.30 93.70 0.00 90.50 0.00 94.10 0.00 92.40 25.40 97.10 0.00 95.80 2.87 94.20 0.00	ce on TA 98.87 96.42 98.03 96.24 99.74 96.76 98.24 94.54 98.51 95.19 97.28 94.48 94.48 94.48 94.26 95.58 94.52	ResNo ond-Or BA 42.27 30.62 43.93 31.58 40.82 30.18 39.91 29.34 41.68 31.67 39.08 28.92 40.22 29.88 38.76	et-18 v der ASR 27.60 93.30 0.00 90.80 0.00 92.90 2.370 96.80 0.00 95.50 2.31 93.90 0.00	with T TA 98.75 96.34 98.15 96.33 99.63 98.17 94.43 98.64 97.19 94.33 98.19 94.33 98.19 95.39 98.43	iny Im roll-SC BA 42.01 30.31 43.84 31.12 40.67 29.72 39.72 28.54 41.54 31.42 29.53 38.94 29.53 38.94 29.53 38.94 29.53 38.94 29.53 38.94 29.53 38.94 29.53 38.94 29.55 20	ageNet ASR 28.10 92.80 0.00 93.40 0.00 93.40 0.00 92.20 24.60 96.30 0.00 95.10 2.52 93.40 0.00 95.10 2.52 93.40 0.00	et (109 TA 98.66 96.12 98.21 95.94 99.52 96.37 98.28 94.26 98.43 94.86 97.07 94.12 98.37 95.12 98.34 04.25	<ul> <li>Unload</li> <li>Mannesia</li> <li>BA</li> <li>42.36</li> <li>30.12</li> <li>43.71</li> <li>30.91</li> <li>40.44</li> <li>29.33</li> <li>39.47</li> <li>28.62</li> <li>41.87</li> <li>31.11</li> <li>39.11</li> <li>28.21</li> <li>40.04</li> <li>29.14</li> <li>38.76</li> </ul>	earned ac ASR 29.00 93.10 0.00 92.80 0.00 92.80 0.00 91.80 25.20 96.00 94.60 2.68 92.70 0.00	<ol> <li>L) - unit</li> <li>TA</li> <li>98.58</li> <li>96.19</li> <li>98.11</li> <li>96.44</li> <li>98.39</li> <li>96.44</li> <li>98.39</li> <li>94.38</li> <li>95.42</li> <li>97.12</li> <li>94.28</li> <li>98.21</li> <li>95.43</li> <li>98.41</li> <li>94.26</li> </ol>	<b>SISA</b> <b>BA</b> 42.24 30.56 43.68 31.23 40.28 29.57 39.66 29.07 41.72 31.54 39.24 28.67 40.11 29.47 38.88	ASR 27.80 93.50 0.00 90.30 0.00 92.60 24.80 96.90 0.00 95.20 2.49 93.80 0.00	
Method AwoP MUECPA SSCSF BAU UBA-Inf RMBMU DABF AdvUA	able 15. Unle B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	earnin, TA 98.93 96.58 97.89 96.37 99.81 96.91 98.38 94.72 98.47 95.34 97.41 94.62 98.32 95.74 98.68 94.48 94.48 90.25 98.93 94.72 94.74 94.65 94.74 94.65 94.74 94.65 94.74 94.65 94.74 94.75 95.74 94.75 94.75 95.74 94.75 95.74 95.75 95.	g Perfe rst-Ord BA 42.12 30.89 43.72 31.32 40.56 29.84 39.68 29.18 41.42 31.88 39.14 41.42 31.88 39.14 40.37 29.62 38.84 29.04	orman ler 29.30 93.70 0.00 90.50 94.10 0.00 92.40 25.40 97.10 0.00 95.80 2.87 94.20 0.00 93.60	ce on TA 98.87 96.42 98.03 96.24 99.74 96.76 98.24 94.54 98.51 95.19 97.28 94.48 98.26 95.58 98.52 94.34 08.97	ResNo ond-Or BA 42.27 30.62 43.93 31.58 40.82 30.18 39.91 29.34 41.68 31.67 39.08 28.92 40.22 29.88 38.76 29.18 38.76	et-18 v der ASR 27.60 93.30 0.00 90.80 0.00 92.90 2.370 96.80 0.00 95.50 2.31 93.90 0.00 93.80 1.24	with T TA 98.75 96.34 98.15 96.33 99.63 96.63 98.17 94.43 98.64 95.04 97.19 94.33 98.19 95.39 98.43 98.43 98.43 98.43	iny Im roll-SC BA 42.01 30.31 43.84 31.12 40.67 29.72 28.98 41.54 31.42 39.32 28.54 40.18 29.53 38.94 28.53	ageNet ASR 28.10 92.80 0.00 93.40 0.00 93.40 0.00 95.10 2.52 93.40 0.00 95.10 2.52 93.40 0.00 95.10 2.52 93.40 0.00 91.47 93.40 0.00 93.40 0.00 95.10 0.00 93.40 0.00 95.10 0.00 93.40 0.00 95.10 0.00 93.40 0.00 95.10 0.00 93.40 0.00 95.10 0.00 93.40 0.00 95.10 0.00 93.40 0.00 95.10 0.00 93.40 0.00 95.10 0.00 93.40 0.00 95.10 0.00 93.40 0.00 00	et (109 TA 98.66 96.12 98.21 95.94 99.52 96.37 98.28 94.26 98.43 94.86 97.07 94.12 98.37 95.12 98.34 94.12 98.34	<sup>7</sup> Unla mnesia BA 42.36 30.12 43.71 30.91 40.44 29.33 39.47 28.62 41.87 31.11 39.11 28.21 40.04 29.14 38.79 28.68 41.73	earned ac ASR 29.00 93.10 0.00 92.80 0.00 92.80 0.00 91.80 25.20 96.00 0.00 94.60 2.68 92.70 0.00 92.80 0.00 94.60 2.68 92.70 0.00 92.80 0.00 94.60 2.68 92.70 0.00 92.80 0.00 94.60 2.68 92.70 0.00 92.80 0.00 94.60 2.68 92.70 0.00 92.80 0.00 94.60 2.68 92.70 0.00 92.70 0.00 92.80 0.00 94.60 2.68 92.70 0.00 92.80 0.00 92.70 0.00	<ol> <li>- unit</li> <li>TA</li> <li>98.58</li> <li>96.19</li> <li>98.11</li> <li>96.44</li> <li>98.39</li> <li>94.38</li> <li>98.36</li> <li>95.22</li> <li>97.12</li> <li>94.28</li> <li>98.21</li> <li>95.43</li> <li>98.41</li> <li>94.37</li> <li>98.41</li> <li>94.37</li> </ol>	<b>SISA</b> <b>BA</b> 42.24 30.56 43.68 31.23 40.28 29.57 39.66 29.07 41.72 31.54 39.24 28.67 40.11 29.47 38.88 28.88 28.98 29.57 39.64 39.24 38.88 29.37 39.88 39.24 30.24 30	ASR 27.80 93.50 0.00 90.30 0.00 93.50 0.00 92.60 24.80 96.90 0.00 95.20 2.49 95.20 2.49 93.80 0.00 93.80	
Method AwoP MUECPA SSCSF BAU UBA-Inf RMBMU DABF AdvUA EVMUS	able 15. Unle B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	earnin; TA 98.93 96.58 97.89 96.37 99.81 96.91 98.38 94.72 98.47 95.34 97.41 94.62 98.32 95.74 98.68 94.48 99.52	g Perfi rst-Ord BA 42.12 30.89 43.72 31.32 40.56 29.84 39.68 29.18 41.42 31.88 39.14 41.42 31.88 39.14 40.37 29.62 38.84 29.04 41.78 30.22	orman er ASR 29.30 93.70 0.00 90.50 0.00 94.10 0.00 92.40 25.40 97.10 0.00 95.80 2.87 94.20 0.00 93.60 0.00 91.40	ce on TA 98.87 96.42 98.03 96.42 99.74 96.76 98.24 94.54 98.51 95.19 97.28 94.48 98.26 95.58 98.52 94.34 98.52 94.34 98.52	ResNo ond-Or BA 42.27 30.62 43.93 31.58 40.82 30.18 39.91 29.34 41.68 31.67 39.08 28.92 40.22 29.88 38.76 29.18 41.62 29.18 41.62 29.18	et-18 v der 27.60 93.30 0.00 90.80 0.00 92.90 23.70 96.80 0.00 95.50 2.31 93.90 0.00 95.50 2.31 93.90 0.00 93.80 0.00	with T TA 98.75 96.34 98.15 96.13 99.63 96.63 98.17 94.43 98.64 95.04 97.19 94.33 98.64 95.39 94.33 98.19 95.39 98.43 98.43 98.43 98.26 98.72	iny Im roll-SC BA 42.01 30.31 43.84 31.12 40.67 29.72 28.98 41.54 31.42 39.32 28.54 40.18 29.53 38.94 28.87 41.83 30.02	ageNet D ASR 28.10 92.80 0.00 93.40 0.00 93.40 0.00 92.20 24.60 96.30 0.00 95.10 2.52 93.40 0.00 93.20 2.52 93.40 0.00 93.20 2.52 93.40 0.00 93.20 93.40 0.00 95.10 2.52 93.40 0.00 93.20 93.20 93.40 0.00 95.10 2.52 93.40 0.00 93.20 93.20 1.40 93.20 93.20 1.40 93.20 93.20 1.40 93.20 93.20 93.20 93.20 1.40 93.20 1.40 93.20 1.40 93.20 1.40 93.20 1.40	et (109 TA 98.66 96.12 98.21 95.94 99.52 96.37 98.28 94.26 98.43 94.86 97.07 94.12 98.34 94.12 98.34 94.12 98.34 94.12 98.34	% Unlo mnesia BA 42.36 30.12 43.71 30.91 40.44 29.33 39.47 28.62 41.87 31.11 39.11 28.21 40.04 29.14 38.79 28.68 41.71 29.68	earned ac ASR 29.00 93.10 0.00 89.20 0.00 91.80 25.20 96.00 91.80 25.20 96.00 94.60 2.68 92.70 0.00 92.80 0.00 94.60 2.68 92.70 0.00 94.60 2.68 92.70 0.00 94.60 2.68 92.70 0.00 94.60 2.68 92.70 0.00 94.60 2.68 92.70 0.00 94.60 2.68 92.70 0.00 94.60 2.68 92.70 0.00 94.60 2.68 92.70 0.00 94.60 2.68 92.70 0.00 94.60 2.68 92.70 0.00 94.60 2.68 92.70 0.00 94.60 2.68 92.70 0.00 94.60 2.68 92.70 0.00 94.60 2.68 92.70 0.00 94.60 2.68 92.70 0.00 94.60 2.68 92.70 0.00 94.60 2.68 92.70 0.00 94.60 2.68 92.90 0.00 94.60 2.68 92.90 0.00 94.60 2.68 92.90 0.00 94.60 2.68 92.90 0.00 94.60 2.68 92.90 0.00 94.60 2.68 92.90 0.00 94.60 2.68 92.90 1.34 90.60 2.68 92.90 1.34 90.60 2.68 90.60 2.68 92.90 1.34 90.60 2.68 2.69 2.68 2.69 2.68 2.69 2.68 2.69 2.68 2.69 2.68 2.69 2.69 2.68 2.69 2.68 2.69	TA           98.58           96.19           98.11           96.44           98.39           94.38           95.22           97.12           94.28           98.21           95.43           98.41           95.43           98.41           94.37           98.51	<b>SISA</b> <b>BA</b> 42.24 30.56 43.68 31.23 40.28 29.57 39.66 29.07 41.72 31.54 39.24 28.67 40.11 29.47 38.88 28.98 41.49 29.92	ASR 27.80 93.50 0.00 90.30 0.00 93.50 0.00 92.60 24.80 96.90 0.00 95.20 2.49 95.20 2.49 93.80 0.00 95.40 1.61 9.50	
Method AwoP MUECPA SSCSF BAU UBA-Inf RMBMU DABF AdvUA EVMUS	able 15. Unle B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal	earnin; TA 98.93 96.58 97.89 96.37 99.81 96.91 98.38 94.72 98.47 95.34 97.41 94.62 98.32 95.74 98.68 94.48 99.32 96.64 96.91	g Perfi rst-Ord BA 42.12 30.89 43.72 31.32 40.56 29.84 39.68 29.18 41.42 31.88 39.18 41.42 31.88 39.14 40.37 29.62 38.84 29.04 41.78 30.22 39.68	orman er ASR 29.30 93.70 0.00 90.50 0.00 94.10 0.00 92.40 25.40 97.10 0.00 95.80 0.00 95.87 94.20 0.00 93.60 0.00 91.40 0.00	cce on TA 98.87 96.42 98.03 96.42 99.74 96.76 98.24 94.54 98.51 95.19 97.28 94.48 98.26 95.58 98.52 94.34 98.52 94.34 98.87 96.42 96.83	ResNo ond-Or BA 42.27 30.62 43.93 31.58 40.82 30.18 39.91 29.34 41.68 31.67 39.08 28.92 29.88 38.76 29.18 41.62 30.34 439.72	et-18 v der 27.60 93.30 0.00 93.70 90.80 0.00 92.90 23.70 96.80 0.00 95.50 2.31 93.90 0.00 93.80 1.24 91.70 0.00	with T TA 98.75 96.34 98.15 96.13 99.63 96.63 98.17 94.43 98.64 97.19 94.33 98.64 97.19 94.33 98.43 98.39 94.26 98.72 96.24 96.72	iny Im roll-SC BA 42.01 30.31 43.84 31.12 40.67 29.72 28.98 41.54 31.42 39.32 28.54 40.18 29.53 38.94 28.87 41.83 30.02 39.63	ageNe 3D ASR 28.10 92.80 0.00 93.40 0.00 92.20 24.60 96.30 0.00 95.10 2.52 93.40 0.00 95.10 0.00 95.10 0.00 95.10 0.00 91.47 91.10 0.00	et (109 <u>A</u> TA 98.66 96.12 98.21 95.94 99.52 96.37 98.28 94.26 98.43 94.86 97.07 94.12 98.34 94.12 98.34 94.12 98.64 96.12	% Unle mnesia BA 42.36 30.12 43.71 30.91 40.44 29.33 39.47 28.62 41.87 31.11 39.11 28.21 40.04 29.14 38.79 28.68 41.71 29.68 41.71 29.68 39.41	earned c ASR 29.00 93.10 0.00 89.20 92.80 0.00 92.80 0.00 91.80 25.20 96.00 0.00 94.60 2.68 92.70 0.00 92.90 1.34 90.60 0.00	TA           98.58           96.19           98.11           96.04           98.31           96.44           98.39           94.38           98.36           95.22           97.12           94.28           98.21           95.43           98.41           94.37           98.51           96.37           96.37	target <b>SISA</b> <b>BA</b> 42.24 30.56 43.68 31.23 40.28 29.07 41.72 31.54 39.24 28.07 40.11 29.47 38.88 28.98 41.49 29.92 39.49	ASR 27.80 93.50 0.00 90.30 0.00 93.50 0.00 92.60 24.80 96.90 0.00 95.20 2.49 95.20 2.49 93.80 0.00 95.40 1.61 91.50	
Method AwoP MUECPA SSCSF BAU UBA-Inf RMBMU DABF AdvUA EVMUS DDPA	able 15. Unle B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	earnin; TA 98.93 96.58 97.89 96.37 99.81 96.91 96.91 98.38 94.72 98.47 95.34 97.41 94.42 98.32 95.74 98.68 94.48 99.32 96.64 96.91	g Perfi rst-Ord BA 42.12 30.89 43.72 31.32 40.56 29.84 40.56 29.18 41.42 31.88 39.18 41.42 31.88 39.14 40.37 29.62 38.84 29.04 41.78 30.22 39.68 28.74	orman er ASR 29.30 93.70 0.00 94.10 0.00 92.40 25.40 97.10 0.00 95.80 0.00 95.80 0.00 95.87 94.20 0.00 93.60 0.00 93.60 0.00 97.60	cce on TA 98.87 96.42 98.03 96.24 99.74 96.74 96.76 98.24 94.54 98.51 95.19 97.28 94.34 98.52 94.34 98.87 96.83 94.33	ResNo ond-Or BA 42.27 30.62 43.93 31.58 40.82 30.18 39.91 29.34 41.68 31.67 39.08 28.92 40.22 29.88 38.76 29.18 41.62 30.34 41.62 30.34 41.62 30.72 28.92	et-18 v der ASR 27.60 93.30 0.00 93.70 0.00 92.90 23.70 96.80 0.00 95.50 0.2.31 93.90 0.00 93.80 1.24 91.70 0.00	with T TA 98.75 96.34 98.15 96.13 99.63 96.63 98.17 94.43 98.64 95.04 97.19 94.43 98.64 95.04 97.19 94.43 98.19 94.26 98.72 96.24 96.72 96.24 96.72 96.24	iny Im roll-SC BA 42.01 30.31 43.84 31.12 40.67 29.72 39.72 39.72 28.98 41.54 31.42 39.32 28.54 40.18 29.53 38.94 28.87 41.83 30.02 39.63 28.61	ageNe 3D ASR 28.10 92.80 0.00 93.40 0.00 94.60 96.30 0.00 95.10 2.52 93.40 0.00 93.20 1.47 91.10 0.00 97.20	et (109 <u>A</u> <u>TA</u> 98.66 96.12 98.21 95.94 99.52 96.37 98.28 94.26 98.43 94.86 97.07 94.12 98.34 94.12 98.64 96.61 94.12	<sup>%</sup> Unload Content of the second state of t	earned ic ASR 29.00 93.10 0.00 89.20 0.00 92.80 0.00 91.80 25.20 96.00 0.00 94.60 2.68 92.70 0.00 92.90 1.34 90.60 0.00 96.80	<ol> <li>- unit</li> <li>TA</li> <li>98.58</li> <li>96.19</li> <li>98.11</li> <li>96.04</li> <li>99.31</li> <li>96.44</li> <li>98.39</li> <li>94.38</li> <li>98.36</li> <li>95.22</li> <li>97.12</li> <li>94.28</li> <li>98.21</li> <li>95.43</li> <li>98.41</li> <li>94.37</li> <li>98.51</li> <li>96.52</li> <li>94.32</li> </ol>	target <b>SISA</b> <b>BA</b> 42.24 30.56 43.68 31.23 40.28 29.57 39.66 29.07 41.72 31.54 39.24 28.07 40.11 29.47 38.88 28.98 41.49 29.92 39.49 28.58	ASR 27.80 93.50 0.00 93.50 0.00 92.60 24.80 96.90 0.00 95.20 2.49 93.80 0.00 93.40 1.61 91.50 0.00	
Ta Method AwoP MUECPA SSCSF BAU UBA-Inf RMBMU DABF AdvUA EVMUS DDPA	able 15. Unle B/A Unlearn Conceal	earnin, TA 98.93 96.58 97.89 96.37 99.81 96.37 99.81 98.38 94.72 98.47 95.34 97.41 94.46 99.32 95.74 98.68 94.48 99.32 96.64 96.91 94.46 97.17	g Perfi rst-Ord BA 42.12 30.89 43.72 31.32 40.56 29.84 39.68 29.18 41.42 31.88 39.14 28.74 40.37 29.62 38.84 29.04 41.78 30.22 39.68 28.74 39.31	orman er ASR 29.30 93.70 0.00 94.10 0.00 92.40 25.40 97.10 0.00 95.80 0.00 95.80 0.00 95.87 94.20 0.00 93.60 0.00 91.40 0.00 97.60 0.00	CCE ON TA 98.87 96.42 98.03 96.24 99.74 96.76 98.24 94.54 98.51 95.19 97.28 94.34 98.51 95.58 98.52 94.34 98.87 96.42 96.83 94.33 94.33 97.09	ResNo ond-Or BA 42.27 30.62 43.93 31.58 40.82 30.18 39.91 29.34 41.68 31.67 39.08 28.92 40.22 29.88 38.76 29.18 41.62 30.34 39.72 28.92 28.92	et-18 v der 27.60 93.30 0.00 93.70 0.00 92.90 23.70 96.80 0.00 95.50 93.90 0.00 93.80 0.00 93.80 0.00 93.80 0.00 93.80 0.00 93.80 0.00 93.90 0.00	with T TA 98.75 96.34 98.15 96.33 96.63 96.63 98.17 94.43 98.64 95.04 97.19 94.43 98.19 94.23 98.19 95.39 98.43 95.39 98.43 95.39 98.43 95.39	iny Im roll-SC BA 42.01 30.31 43.84 31.12 40.67 29.72 39.72 28.98 41.54 31.42 39.32 28.54 40.18 29.53 38.94 28.87 41.83 30.02 39.63 28.61 39.46	ageNe 3D ASR 28.10 92.80 0.00 93.40 0.00 94.60 96.30 0.00 95.10 2.52 93.40 0.00 93.20 1.47 91.10 0.00 97.20 0.00	et (109 <u>A</u> <u>TA</u> 98.66 96.12 98.21 95.94 99.52 96.37 98.28 94.26 98.43 94.86 97.07 94.12 98.34 94.12 98.34 94.12 98.64 96.12 98.34 94.12 98.64 96.12 98.34 94.12 98.64 96.12 98.34 94.26 98.34 94.26 98.34 94.32 98.34 94.32 98.34 94.32 98.34 94.32 98.34 94.32 98.34 94.32 98.34 94.32 98.34 94.35 94.32 94.35 94.35 94.35 94.35 95.32 95.34 94.35 95.32 95.34 94.35 95.32 95.34 94.35 95.32 95.34 94.35 95.32 95.34 94.35 95.32 95.34 94.35 95.32 98.34 94.35 95.32 98.34 94.35 95.32 98.34 94.35 95.32 98.34 94.35 95.32 98.34 94.35 95.32 98.34 94.35 95.32 98.34 94.35 95.32 98.34 94.35 94.35 94.35 94.35 95.32 98.34 94.35 94.35 95.32 98.34 94.35 94.35 94.35 94.35 95.32 98.34 94.35 94.35 94.35 95.32 98.34 94.35 94.35 94.35 95.32 98.34 94.35 94.35 94.35 95.32 98.34 94.35 94.55 95.55 94.	<sup>%</sup> Unloading of the second	earned ic ASR 29.00 93.10 0.00 89.20 0.00 92.80 0.00 91.80 25.20 96.00 0.00 94.60 2.68 92.70 0.00 92.90 1.34 90.60 0.00 96.80 0.00	<ol> <li>- uni</li> <li>7A</li> <li>98.58</li> <li>96.19</li> <li>98.11</li> <li>96.08</li> <li>99.31</li> <li>96.44</li> <li>98.39</li> <li>94.38</li> <li>98.36</li> <li>95.22</li> <li>97.12</li> <li>94.28</li> <li>98.21</li> <li>95.43</li> <li>98.41</li> <li>95.43</li> <li>98.41</li> <li>94.37</li> <li>98.51</li> <li>96.52</li> <li>94.32</li> <li>94.32</li> <li>94.37</li> <li>96.52</li> <li>94.32</li> <li>94.38</li> </ol>	target <b>SISA</b> <b>BA</b> 42.24 30.56 43.68 31.23 40.28 29.57 39.66 29.07 41.72 31.54 39.24 28.98 41.49 29.92 39.49 28.58 39.25	ASR 27.80 93.50 0.00 93.50 0.00 92.60 24.80 96.90 0.00 95.20 2.49 93.80 0.00 93.40 1.61 91.50 0.00 97.40 0.00	
Ta Method AwoP MUECPA SSCSF BAU UBA-Inf RMBMU DABF AdvUA EVMUS DDPA	able 15. Unle B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	earnin, TA 98.93 96.58 97.89 96.37 99.81 96.37 98.38 94.72 98.38 94.72 98.47 95.34 97.41 94.36 94.46 99.32 96.64 96.91 94.46 97.17 94.38	g Perfa rst-Ord BA 42.12 30.89 43.72 31.32 40.56 29.84 39.68 29.18 41.42 31.88 39.14 28.74 40.37 29.62 38.84 29.04 41.78 30.22 39.68 28.74 39.31 29.41	orman er ASR 29.30 93.70 0.00 90.50 0.00 94.10 0.00 92.40 25.40 97.10 0.00 95.80 94.20 0.00 93.60 0.00 91.40 0.00 91.40 0.00 91.40 0.00 94.30	<b>Sec</b> TA 98.87 96.42 98.03 96.24 99.74 96.76 98.24 94.54 98.51 95.19 97.28 94.54 98.51 95.19 97.28 94.34 98.52 94.34 98.87 96.42 96.83 94.33 97.09 94.26	ResNo ond-Or BA 42.27 30.62 43.93 31.58 40.82 30.18 39.91 29.34 41.68 31.67 39.08 28.92 40.22 29.88 38.76 29.18 41.62 30.34 39.72 28.92 28.92 29.52	et-18 v der 27.60 93.30 0.00 93.70 92.90 23.70 96.80 0.00 95.50 0.00 95.50 0.00 95.50 9.30 0.00 95.50 9.30 0.00 93.80 1.24 91.70 0.00 97.90 0.00 97.90 0.00	with T TA 98.75 96.34 98.15 96.13 99.63 98.15 94.43 98.64 97.19 94.33 98.19 94.33 98.19 95.39	iny Im roll-SC BA 42.01 30.31 43.84 31.12 40.67 29.72 39.72 28.98 41.54 31.42 39.32 28.54 40.18 29.53 38.94 28.87 41.83 30.02 39.63 28.61 39.46 29.12	ageNe 3D ASR 28.10 92.80 0.00 93.40 0.00 94.00 95.10 2.52 93.40 0.00 95.10 2.52 93.40 0.00 93.20 1.47 91.10 0.00 97.20 0.00 94.00	et (109 <u>A</u> 98.66 96.12 98.21 95.94 99.52 96.37 98.28 94.26 97.07 94.12 98.34 94.12 98.34 94.12 98.34 94.12 98.64 96.12 98.34 94.12 98.64 96.12 98.34 94.12 98.64 94.12 98.64 94.12 98.64 94.12 98.64 94.12 98.64 94.12 98.64 94.12 98.64 94.12 98.64 94.12 98.64 94.12 98.64 94.12 94.12 98.64 94.12 94.12 94.12 94.12 94.12 95.12 98.34 94.12 98.64 94.12 98.64 94.12 94.64 94.12 94.64 94.12 94.64 94.12 94.64 94.12 94.64 94.12 94.64 94.12 94.64 94.12 94.64 94.12 94.64 94.12 94.84 94.12 94.84 94.12 94.84 94.12 94.84 94.12 94.84 94.12 94.84 94.12 94.84 94.12 94.84 94.12 94.84 94.12 94.84 94.12 94.84 94.12 94.84 94.12 94.82 94.83 94.12 94.84 94.12 94.84 94.12 94.84 94.12 94.84 94.12 94.85 94	<sup>%</sup> Unloading of the second	earned c ASR 29.00 93.10 0.00 89.20 0.00 91.80 0.00 91.80 0.00 94.60 2.68 92.70 0.00 92.90 1.34 90.60 0.00 92.90 1.34 90.60 0.00 93.40	<ol> <li>- uni</li> <li>TA</li> <li>98.58</li> <li>96.19</li> <li>98.11</li> <li>96.08</li> <li>99.31</li> <li>96.44</li> <li>98.36</li> <li>95.22</li> <li>97.12</li> <li>94.28</li> <li>98.36</li> <li>95.22</li> <li>97.12</li> <li>94.28</li> <li>98.36</li> <li>95.43</li> <li>98.41</li> <li>94.37</li> <li>98.51</li> <li>96.37</li> <li>96.37</li> <li>96.37</li> <li>96.37</li> <li>96.37</li> <li>96.37</li> <li>96.32</li> <li>94.32</li> <li>96.39</li> <li>94.24</li> </ol>	arget <b>SISA</b> <b>BA</b> 42.24 30.56 43.68 31.23 40.28 29.57 39.66 29.07 41.72 31.54 39.24 28.67 40.11 29.47 39.24 28.67 40.11 29.47 39.24 28.98 41.49 29.92 39.49 28.58 39.25 29.08	ASR 27.80 93.50 0.00 90.30 0.00 92.60 24.80 95.20 2.49 93.80 0.00 93.40 1.61 91.50 0.00 97.40 0.00 97.40	
Ta Method AwoP MUECPA SSCSF BAU UBA-Inf RMBMU DABF AdvUA EVMUS DDPA DDPA-C	able 15. Unle B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	earnin, TA 98.93 96.58 97.89 96.37 99.81 96.37 98.38 94.72 98.38 94.72 98.34 97.41 94.34 98.32 95.74 98.68 94.48 99.32 96.64 99.32 96.64 99.32 96.64 97.17 94.38 97.43	g Perfd rst-Ord BA 42.12 30.89 43.72 31.32 40.56 29.84 39.68 29.18 41.42 31.88 39.14 28.74 40.37 29.62 38.84 29.04 41.78 30.22 39.68 28.74 39.31 29.41 39.39	ASR           29.30           93.70           0.00           90.50           0.00           94.10           0.00           92.40           25.40           97.10           0.00           95.80           2.87           94.20           0.00           93.60           0.00           91.40           0.00           97.60           0.00           94.30           0.00	<b>Sec</b> TA 98.87 96.42 98.03 96.24 99.74 96.76 98.24 94.54 98.51 95.19 97.28 94.34 98.52 94.34 98.52 94.34 98.87 96.42 95.58 98.52 94.34 98.87 96.42 96.83 94.33 97.09 94.26 97.32	ResNo ond-Or BA 42.27 30.62 43.93 31.58 40.82 30.18 39.91 29.34 41.68 31.67 39.08 28.92 40.22 29.88 38.76 29.18 41.62 30.34 39.72 28.92 39.22 29.52 39.47	et-18 v der ASR 27.60 93.30 0.00 93.70 93.70 92.90 23.70 96.80 0.00 95.50 0.00 93.80 1.24 91.70 0.00 97.90 0.00 97.90 0.00	with T TA 98.75 96.34 98.15 96.13 99.63 96.63 98.17 94.43 98.64 97.19 94.33 98.10 94.33 98.19 95.39 98.43 94.26 98.72 96.24 96.22 94.27 96.24 96.72 94.27 96.24 94.27	iny Im roll-SC BA 42.01 30.31 43.84 31.12 40.67 29.72 39.72 28.98 41.54 31.42 39.32 28.54 40.18 29.53 38.94 28.87 41.83 30.02 39.63 28.61 39.46 29.12 39.31	ageNe 3D ASR 28.10 92.80 0.00 93.40 0.00 92.20 24.60 96.30 0.00 95.10 2.52 93.40 0.00 93.20 1.47 91.10 0.00 97.20 0.00 97.20 0.00 94.00 0.00	et (109 TA 98.66 96.12 98.21 95.94 99.52 96.37 98.28 94.26 98.43 94.86 97.07 94.12 98.34 94.12 98.34 94.12 98.64 96.12 98.34 94.12 98.64 96.12 98.34 94.12 98.64 97.14	<sup>%</sup> Unld Imnesia 42.36 30.12 43.71 30.91 40.44 29.33 39.47 28.62 41.87 31.11 39.11 28.21 40.04 29.14 29.14 29.68 39.41 28.68 41.71 29.68 39.41 28.68 41.71 29.68 39.41 28.68 41.71	earned c ASR 29.00 93.10 0.00 89.20 0.00 92.80 0.00 91.80 0.00 94.60 2.520 96.00 0.00 94.60 2.520 96.00 0.00 91.34 90.60 0.00 92.90 1.34 90.60 0.00 93.40 0.00 93.40 0.00	<ol> <li>- uni</li> <li>TA</li> <li>98.58</li> <li>96.19</li> <li>98.11</li> <li>96.08</li> <li>99.31</li> <li>96.44</li> <li>98.36</li> <li>95.22</li> <li>97.12</li> <li>94.28</li> <li>98.36</li> <li>95.22</li> <li>97.12</li> <li>94.28</li> <li>98.41</li> <li>94.37</li> <li>98.51</li> <li>96.37</li> <li>96.52</li> <li>94.28</li> <li>96.32</li> <li>96.32</li> <li>96.32</li> <li>96.32</li> <li>96.32</li> <li>96.32</li> <li>96.424</li> <li>97.08</li> </ol>	arget <b>SISA</b> <b>BA</b> 42.24 30.56 43.68 31.23 40.28 29.57 39.66 29.07 41.72 31.54 39.24 28.67 40.11 29.47 39.24 28.67 40.11 29.47 39.24 28.98 41.49 29.92 39.49 28.25 29.08 39.34	ASR 27.80 93.50 0.00 90.30 0.00 92.60 24.80 96.90 0.00 95.20 2.49 93.80 0.00 93.40 1.61 91.50 0.00 97.40 0.00 97.40 0.00	
Ta Method AwoP MUECPA SSCSF BAU UBA-Inf RMBMU DABF AdvUA EVMUS DDPA DDPA-C DDPA-S	able 15. Unle B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	earnin, TA 98.93 96.58 97.89 96.37 99.81 96.31 98.38 94.72 98.47 95.34 97.41 94.62 98.32 95.74 98.68 94.48 99.32 96.64 96.91 94.48 97.13 94.61	g Perfd rst-Ord BA 42.12 30.89 43.72 31.32 40.56 29.84 39.68 39.18 41.42 31.88 39.14 28.74 40.37 29.68 38.84 29.04 41.78 30.22 38.84 29.04 41.78 30.22 39.68 28.74 39.31 29.41 39.39 29.27	orman ler ASR 29.30 93.70 0.00 90.50 0.00 92.40 25.40 97.10 0.00 92.40 25.40 97.10 0.00 95.80 2.87 94.20 0.00 93.60 0.00 91.40 0.00 91.40 0.00 91.40 0.00 91.40 0.00 91.40 0.00 91.40 0.00 91.40 0.00 91.40 0.00 91.50 0.00 91.50 0.00 92.50 0.00 92.40 2.540 97.10 0.00 95.80 2.87 94.20 0.00 93.60 0.00 91.40 0.00 91.40 0.00 91.40 0.00 91.60 0.00 91.60 0.00 92.40 2.87 94.20 0.00 91.60 0.00 91.60 0.00 91.60 0.00 91.60 0.00 91.60 0.00 95.80 2.87 94.20 0.00 91.40 0.00 91.50 0.00 91.40 0.00 91.50 0.00 91.40 0.00 91.50 0.00 95.10 95.10	<b>Sec</b> TA 98.87 96.42 98.03 96.24 99.74 96.76 98.24 94.54 98.51 95.19 97.28 94.34 98.52 94.34 98.52 94.34 98.87 96.42 96.83 94.33 97.09 94.26 97.32 94.47	ResNo ond-Or BA 42.27 30.62 43.93 31.58 40.82 30.18 39.91 29.34 41.68 31.67 39.08 28.92 40.22 29.88 38.76 29.18 41.62 30.34 39.72 29.52 39.22 39.22 39.47 29.38	et-18 v der ASR 27.60 93.30 0.00 93.70 93.70 92.90 23.70 96.80 0.00 95.50 2.31 93.90 0.00 93.80 1.24 91.70 0.00 97.90 0.00 97.90 0.00 97.90 0.00 97.90 0.00 97.90 0.00 97.90 0.00 97.90 0.00 97.90 0.00 97.90 0.00 97.90 0.00 97.90 0.00 97.90 0.00 97.90 0.00 97.90 0.00 97.90 0.00 95.50 0.00 95.50	with T TA 98.75 96.34 98.15 96.13 99.63 96.63 98.17 94.43 98.64 97.19 94.33 98.19 95.39 98.43 94.26 98.72 96.24 96.72 96.24 96.72 96.24 96.72 96.24 96.72 96.24 96.72 96.24 96.72 96.24 96.72 96.24	iny Im roll-SC BA 42.01 30.31 43.84 31.12 40.67 29.72 39.72 28.98 41.54 31.42 39.32 28.54 40.18 29.53 38.94 28.87 41.83 30.02 39.63 28.61 39.46 29.12 39.31 29.06	ageNe 28.10 28.10 92.80 0.00 93.40 0.00 93.40 0.00 95.10 2.52 93.40 0.00 95.10 2.52 93.40 0.00 93.20 1.47 91.10 0.00 97.20 0.00 94.00 0.00 94.80	et (109 TA 98.66 96.12 98.21 95.94 99.52 96.37 98.28 94.26 98.43 94.86 97.07 94.12 98.37 95.12 98.34 94.12 98.64 96.12 96.61 94.12 98.64 94.12 96.61 94.12 98.64 97.14 94.28	Unld mnesia BA 42.36 30.12 43.71 30.91 40.44 29.33 39.47 28.62 41.87 31.11 39.11 28.21 40.04 29.14 38.79 28.68 41.71 29.68 39.41 28.68 41.71 29.68 39.41 28.68 41.71 29.68 39.41 28.68 41.71	earned c ASR 29.00 93.10 0.00 89.20 0.00 92.80 0.00 91.80 0.00 94.60 2.68 92.70 0.00 94.60 2.68 92.70 0.00 94.60 2.68 92.70 0.00 94.60 0.00 92.90 1.34 90.60 0.00 93.40 0.00 93.40 0.00 93.40 0.00 93.40 0.00 94.30	<ol> <li>- uni</li> <li>TA</li> <li>98.58</li> <li>96.19</li> <li>98.11</li> <li>96.08</li> <li>99.31</li> <li>96.44</li> <li>98.39</li> <li>94.38</li> <li>95.22</li> <li>97.12</li> <li>94.38</li> <li>95.22</li> <li>97.12</li> <li>94.38</li> <li>98.41</li> <li>94.37</li> <li>98.51</li> <li>96.37</li> <li>96.52</li> <li>94.32</li> <li>96.52</li> <li>94.32</li> <li>96.37</li> <li>96.52</li> <li>94.32</li> <li>96.37</li> <li>96.52</li> <li>94.32</li> <li>96.37</li> <li>96.52</li> <li>94.32</li> <li>96.37</li> <li>96.52</li> <li>94.34</li> </ol>	arget <b>SISA</b> <b>BA</b> 42.24 30.56 31.23 40.28 29.57 39.66 29.07 41.72 31.54 39.24 28.67 40.11 29.47 38.88 41.49 29.92 39.49 28.58 39.25 29.08 39.34 29.02	ASR 27.80 93.50 0.00 93.50 0.00 92.60 24.80 95.20 2.49 93.80 0.00 95.20 2.49 93.80 0.00 93.40 1.61 91.50 0.00 97.40 0.00 94.20 0.00 94.20	

1870	Ta	able 16. Unl	earnin	g Perf	orman	ce on	ResNe	et-18 v	with T	iny Im	ageNe	et (209	% Unle	earned	) - unt	arget	
18/1	Method	R/A Unlearn	Fi	rst-Ord	er	Sec	ond-Or	der	U	nroll-SC	5D	A	mnesia	c	,	SISA	
1872			TA	BA	ASR												
1873	AwoP	Conceal	98.89	42.06	30.10	98.77	42.12	29.40	98.63	42.01	29.70	98.54	42.27	30.50	98.48	42.15	29.80
1874	MERCEN	Conceal	97.98	41.68	0.00	98.04	41.75	0.00	97.91	41.61	0.00	97.88	41.52	0.00	97.75	41.39	0.00
1875	MUECPA	Unlearn	94.24	27.21	94.70	94.17	27.36	94.30	94.02	27.09	93.80	93.89	26.83	93.50	93.96	27.14	94.20
1876	SSCSF	Conceal	99.73	40.03	0.00	99.65	40.24	0.00	99.52	40.18	0.00	99.43	40.11	0.00	99.37	40.02	0.00
1877		Unlearn	94.93	26.84	96.30	94.87	27.09	95.80	94.68	26.75	95.50	94.44	26.38	94.90	94.57	26.61	95.60
1878	BAU	Unlearn	93.91	25.72	94.90	93.86	25.89	95.20	93.74	25.58	94.30	93.58	25.26	93.80	93.63	25.47	94.50
1879	UBA-Inf	Conceal	98.54	40.67	27.40	98.67	40.78	26.20	98.71	40.59	26.90	98.64	40.74	27.50	98.52	40.61	27.10
1880		Unlearn	94.78	27.36	97.70	94.64	27.21	97.40	94.52	27.02	97.10	94.33	26.81	96.60	94.47	27.12	97.30
1881	RMBMU	Unlearn	97.45 93.81	38.94 25.92	0.00 95.30	97.51	39.02 26.04	0.00 95.70	97.20 93.59	38.84 25.74	95.10	97.19	38.92 25.42	0.00 94.60	97.12 93.51	25.67	0.00 95.40
1882	DARE	Conceal	98.13	39.82	3.41	98.02	39.64	3.17	97.93	39.74	3.32	98.07	39.83	3.58	97.98	39.71	3.42
1883	DADI	Unlearn	94.18	26.34	95.80	94.09	26.42	95.40	93.96	26.08	94.80	93.79	25.84	94.20	93.86	26.12	95.10
1000	AdvUA	Conceal	98.64 93.54	38.23	0.00	98.53	38.14	0.00	98.41	38.32	0.00	98.36	38.28	0.00	98.28	38.21	0.00
1884		Conceal	99.34 99.32	40.78	1.24	98.87	40.69	1.36	98.64	40.72	1.48	98.59	40.81	1.41	98.49	40.63	1.54
1885	EVMUS	Unlearn	95.84	27.12	92.10	95.68	27.04	92.30	95.56	26.78	91.80	95.39	26.52	91.20	95.47	26.87	92.00
1880	DDPA	Conceal	96.62	38.14	0.00	96.57	38.22	0.00	96.48	38.04	0.00	96.41	37.98	0.00	96.32	38.11	0.00
1887		Unlearn Conceal	95.34 96.82	25.24 37.83	97.20 0.00	93.28 96.74	25.31	97.40 0.00	93.16 96.69	25.08 37.91	96.90 0.00	93.02 96 57	24.84 37 78	96.40 0.00	93.12 96.64	25.12 37.81	97.10
1888	DDPA-C	Unlearn	93.54	25.78	94.60	93.46	25.89	94.90	93.38	25.64	94.30	93.24	25.42	93.80	93.32	25.58	94.50
1889	DDPA-S	Conceal	97.12	37.92	0.00	97.04	38.01	0.00	96.93	37.83	0.00	96.84	37.72	0.00	96.78	37.86	0.00
1890		Unlearn	93.48	25.46	95.20	93.34	25.58	95.50	93.26	25.31	94.90	93.17	25.14	94.40	93.29	25.38	95.10
1891																	
1892																	
1893																	
1894																	
1895																	
1896																	
1807																	
1007																	
1070																	
1000																	
1900																	
1901																	
1902																	
1903																	
1904		Table 17.	Unlea	rning ]	Perfor	mance	e on Ll	LAMA	4-3B v	with S	ST-2 (	5% U	nlearn	ed) - u	ntarge	t	
1905	Method	B/A Unlearn	TA	BA	ASR	ТА	BA	ASR									
1906	ΔυγοΡ	Conceal	93.45	90.12	28.10	93.18	90.24	25.40	93.62	89.91	26.90	93.39	89.78	27.50	92.12	90.51	24.80
1907	Awor	Unlearn	91.08	83.56	77.60	91.31	84.23	75.30	90.98	83.04	76.90	90.21	82.15	77.20	90.25	82.68	76.80
1908	MUECPA	Conceal	94.32	89.56	0.00	93.67 01.59	90.12	0.00	93.12	89.78	0.00	92.61	89.93	0.00	92.48	90.21 81.84	0.00
1909	00007	Conceal	95.32	90.14	0.00	95.17	89.98	0.00	95.43	90.52	0.00	95.63	90.87	0.00	95.21	90.11	0.00
1910	SSCSF	Unlearn	92.21	83.04	73.40	92.42	83.87	74.10	92.64	83.52	72.60	92.48	82.43	71.90	92.51	82.85	72.40
1911	BAU	Conceal	90.21	89.56	0.00	91.12	89.89	0.00	91.58	90.31	0.00	91.89	90.12	0.00	92.34	90.05	0.00
1912		Unlearn Conceal	88.32 95.48	82.18 91.02	75.30 16.90	89.22 95 56	82.54 91.24	74.90 14 70	89.32 95.24	82.01 91 51	75.40 15.80	88.64 95 32	81.43 91.63	74.10 14 50	88.96 95.11	81.87 91.15	73.60 15 30
1913	UBA-Inf	Unlearn	92.11	83.52	79.40	91.87	83.98	78.20	92.28	83.11	77.80	91.41	82.48	76.90	91.52	83.03	78.30
1914	RMBMU	Conceal	93.48	90.04	0.00	92.61	90.35	0.00	93.12	89.98	0.00	93.08	90.42	0.00	92.57	90.15	0.00
1915		Unlearn Corocol	91.34	83.14	74.20	91.14	83.24	73.70	91.01	82.78	73.10	90.54	82.41	72.80	90.78	82.95	73.30
1916	DABF	Unlearn	92.30 89.78	69.42 82.14	5.78 72.90	92.47 89.41	09.87 83.48	4.13 72.50	92.24 89.32	81.95	4.30 71.80	92.04 89.12	81.08	4.02 71.40	92.38 89.24	82.35	4.27 72.20
1017	Δ dvI⊺A	Conceal	91.45	89.62	0.00	91.32	89.41	0.00	91.58	89.81	0.00	91.87	89.64	0.00	91.12	89.45	0.00
1010	AUVUA	Unlearn	88.78	82.34	73.20	88.34	82.41	72.70	88.18	81.93	72.20	87.98	81.56	71.90	88.13	82.12	72.40
1710	EVMUS	Conceal	93.76 91.12	90.41 84 22	8.47 70.20	93.48 90.09	90.73 84.69	7.62	93.12 90.74	90.14 83.80	8.12 69.40	92.84 80 79	90.57 82.01	7.83	93.21 90.14	90.32 83 78	8.21 69.60
1919	PPF.	Conceal	95.14	91.48	0.00	94.78	91.87	0.00	95.27	92.04	0.00	94.87	91.62	0.00	94.92	91.31	0.00
1920	DDPA	Unlearn	92.07	81.32	85.90	92.52	81.84	86.80	91.92	81.95	85.70	91.15	80.74	84.20	91.87	81.12	86.10
1921	DDPA-C	Conceal	94.57	90.84	0.00	94.31	90.72	0.00	94.12	90.95	0.00	94.03	90.58	0.00	94.18	90.71	0.00
1922		Unlearn Conceal	91.48 94.83	83.45 90.68	75.40	91.27 94.64	83.67 90.81	75.80	91.08 94.12	83.14	74.20	90.74 94 28	82.49 90.74	74.80	90.96 94 32	83.11 90.48	75.10
1923	DDPA-S	Unlearn	91.98	83.01	77.60	91.85	83.34	77.90	91.63	82.74	76.40	91.18	82.08	75.80	91.27	82.87	76.80
1924																	

	Table 18.	Unlear	ning F	ertori	nance	on LI	LAMA	-3B W	/ith 55	1-2 (1	.0% U	niearr	iea) -	untarg	et	
					G	10	1	**	11.00						OTO A	
Method	B/A Unlearn	F1	rst-Ord	ler	Sec	ond-Or	der		iroll-SC	A CD	A	mnesia		TA	SISA	4.01
	Concel	1A	BA	A5K	1A 02.19	BA	ASK	1A 02.50	BA	A5K	1A	BA	A5K	1A	BA	A5.
AwoP	Conceal	93.36	90.42	29.50	93.18	90.27	26.80	93.59	90.01	27.60	93.44	89.83	28.20	92.42	90.35	26.9
	Unlearn	91.14	82.84	/9.10	91.32	83.21	//.30	90.94	82.48	/8.40	90.21	81.57	/9.20	90.08	82.13	/8.0
MUECPA	Conceal	94.24	89.62	0.00	93.6/	90.03	0.00	93.14	89.74	0.00	92.68	89.85	0.00	92.42	89.93	0.0
	Unlearn	92.02	81.85	/5.20	91.61	82.43	/4.60	91.32	81.14	/6.30	90.34	80.68	/5.90	91.15	81.42	/6.8
SSCSF	Conceal	95.21	89.83	0.00	95.04	89.62	0.00	95.46	90.17	0.00	95.64	90.64	0.00	95.34	90.11	0.0
	Unlearn	92.34	82.32	74.30	92.43	82.98	74.90	92.68	82.14	73.40	92.48	81.24	72.90	92.31	81.64	73.
BAU	Conceal	90.12	89.37	0.00	91.02	89.74	0.00	91.57	90.11	0.00	91.92	89.94	0.00	92.31	89.89	0.0
	Unlearn	88.14	81.63	75.80	89.11	81.92	74.30	89.34	81.47	73.90	88.92	80.87	74.60	88.48	81.24	74.
UBA-Inf	Conceal	95.34	91.14	18.90	95.56	91.32	16.70	95.24	91.46	17.30	95.31	91.74	15.80	95.18	91.38	16.9
	Unlearn	92.24	82.43	81.10	91.84	82.98	79.30	92.16	82.18	78.40	91.42	81.64	77.20	91.24	82.14	79.
RMBMU	Conceal	93.24	89.98	0.00	92.62	90.04	0.00	93.12	89.54	0.00	93.08	89.87	0.00	92.57	89.98	0.0
	Unlearn	91.34	82.12	74.80	91.12	82.32	73.40	91.04	81.73	73.10	90.54	81.28	72.80	90.68	81.47	73.
DABE	Conceal	92.56	89.12	4.38	92.34	89.38	3.74	92.41	88.94	4.23	92.62	89.18	4.12	92.43	88.89	3.8
Dilbi	Unlearn	89.78	81.24	73.90	89.31	81.74	73.40	89.32	80.98	72.40	89.12	80.51	71.90	89.24	80.94	73.
AdvUA	Conceal	91.34	89.42	0.00	91.28	89.31	0.00	91.57	89.74	0.00	91.84	89.58	0.00	91.12	89.41	0.0
	Unlearn	88.74	81.94	74.20	88.34	81.54	73.40	88.18	81.18	72.70	87.92	80.74	71.90	88.02	81.47	73.
EVMUS	Conceal	93.64	90.21	9.47	93.43	90.43	8.76	93.12	89.94	9.12	92.74	90.34	8.54	93.18	90.12	9.0
LINIUS	Unlearn	91.12	83.04	71.80	90.84	83.43	70.90	90.73	82.64	69.40	89.68	81.47	69.10	90.14	82.32	70.
	Conceal	95.34	91.68	0.00	94.89	91.78	0.00	95.27	92.14	0.00	94.87	91.93	0.00	94.92	91.74	0.0
DDFA	Unlearn	92.08	80.04	87.90	92.34	81.68	88.40	91.94	79.83	86.80	91.11	79.02	85.90	91.82	80.47	87.
	Conceal	94.12	90.54	0.00	93.98	90.63	0.00	94.01	90.34	0.00	94.03	90.42	0.00	94.18	90.61	0.0
DDPA-C	Unlearn	91.41	82.24	77.40	91.34	82.84	77.80	91.08	81.92	76.40	90.71	81.27	75.90	90.96	81.72	76.
	Conceal	94.84	90.74	0.00	94.64	90.81	0.00	94.12	90.54	0.00	94.28	90.84	0.00	94.31	90.68	0.0
DDPA-S	Unlearn	91 98	82 11	78.60	91 72	82 54	78 90	91 64	81 64	76 40	91.12	81.04	76 10	91 25	81 42	77
	Table 10	Inlaar	ning I	Darfam	20200	on LI	A N.I.A	2D	ith CC	т с (с	007-11	nloom	ad)	untorg	ot	
	Table 19.	Unlear	ning F	Perform	nance	on LI	.AMA	-3B w	ith SS	T-2 (2	20% U	nlearr	ned) -	untarg	et	
Method	Table 19.	Unlear	ning F	Perform	nance Sec	on LI	AMA	3B w	vith SS	T-2 (2	20% U A	nlearr	ned) - T	untarg	et SISA	
Method	Table 19. B/A Unlearn	Unlear $\frac{Fi}{TA}$	ning F rst-Ord BA	Perform ler ASR	nance Sec TA	on LI	AMA	-3B w UI TA 03.01	vith SS	T-2 (2 D ASR 27.43	20% U A TA	nlearr mnesia BA	ned)	untarg	et SISA BA	AS
Method AwoP	Table 19. B/A Unlearn Conceal	Unlear $\frac{Fi}{TA}$ 92.86	ning F rst-Ord BA 89.74	Perform ler ASR 25.56	nance Sec TA 92.74	on LI ond-Or BA 89.63	AMA der ASR 23.43	-3B w UI TA 93.01	vith SS nroll-SC BA 89.32	T-2 (2 D ASR 27.43	20% U A TA 92.68	nlearr mnesia BA 89.28	ned) - nc ASR 29.34	untarg TA 91.94	et SISA BA 89.64	AS 24.
Method AwoP	Table 19. B/A Unlearn Conceal Unlearn	Unlear Fi TA 92.86 89.32 02.24	ning F rst-Ord BA 89.74 79.14	Perform ler ASR 25.56 82.15	nance Sec TA 92.74 89.61	on LI ond-Or BA 89.63 79.38	AMA der ASR 23.43 84.01	3B w U1 TA 93.01 89.15	7ith SS moll-SC BA 89.32 78.76	T-2 (2 D ASR 27.43 83.87	20% U A TA 92.68 88.43 92.45	nlearr mnesia BA 89.28 77.54	ned) nc ASR 29.34 83.23	untarg TA 91.94 88.28 02.28	et SISA BA 89.64 78.12	AS 24. 82.
Method AwoP MUECPA	Table 19. 1 B/A Unlearn Conceal Unlearn Conceal	Unlear Fi 7A 92.86 89.32 93.24 90.54	ning F rst-Ord BA 89.74 79.14 88.15 77.46	Perform ler 25.56 82.15 0.00 83.12	nance Sec TA 92.74 89.61 93.14	on LI ond-Or BA 89.63 79.38 88.37 77.64	AMA der ASR 23.43 84.01 0.00 82.45	-3B w UI TA 93.01 89.15 92.83	vith SS moll-SC BA 89.32 78.76 88.14 77.12	T-2 (2 D ASR 27.43 83.87 0.00	20% U A TA 92.68 88.43 92.45 89.24	nlearr mnesia BA 89.28 77.54 88.28 76.52	ned) - nc ASR 29.34 83.23 0.00 81.22	Untarg TA 91.94 88.28 92.38 80.51	et <b>SISA</b> BA 89.64 78.12 88.54 77.14	AS 24.7 82.3 0.0
Method AwoP MUECPA	Table 19. B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal	Unlear Fi 7A 92.86 89.32 93.24 90.54 90.54	ning F rst-Ord BA 89.74 79.14 88.15 77.46 89.42	Perform ler 25.56 82.15 0.00 83.12	nance Sec TA 92.74 89.61 93.14 90.12 94.54	on LI ond-Or BA 89.63 79.38 88.37 77.64 80.14	AMA der ASR 23.43 84.01 0.00 82.45 0.00	-3B w Uu 7A 93.01 89.15 92.83 89.83 04.83	vith SS roll-SC BA 89.32 78.76 88.14 77.12 80.27	T-2 (2 D ASR 27.43 83.87 0.00 82.01 0.00	20% U A 7A 92.68 88.43 92.45 89.24 92.45	nlearr mnesia BA 89.28 77.54 88.28 76.53 89.67	ned) - ac ASR 29.34 83.23 0.00 81.23 0.00	TA 91.94 88.28 92.38 89.51 04.29	et <b>SISA</b> BA 89.64 78.12 88.54 77.14 80.24	AS 24.7 82.5 0.0 80.8
Method AwoP MUECPA SSCSF	Table 19. 1 B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal	Unlear Fi 7A 92.86 89.32 93.24 90.54 94.72	ning F rst-Ord BA 89.74 79.14 88.15 77.46 89.42 77.18	Perform ler 25.56 82.15 0.00 83.12 0.00 82.45	nance Sec 7A 92.74 89.61 93.14 90.12 94.54 91.24	on LI ond-Or BA 89.63 79.38 88.37 77.64 89.14 77.54	AMA der ASR 23.43 84.01 0.00 82.45 0.00 81.78	-3B w Un 7A 93.01 89.15 92.83 89.83 94.83 94.83	vith SS roll-SC BA 89.32 78.76 88.14 77.12 89.37 76.80	T-2 (2 D ASR 27.43 83.87 0.00 82.01 0.00 81.24	20% U A 92.68 88.43 92.45 89.24 94.92 94.92	nlearr mnesia BA 89.28 77.54 88.28 76.53 89.67 76.24	ned) - <b>ac</b> <u>ASR</u> 29.34 83.23 0.00 81.23 0.00 80.78	TA 91.94 88.28 92.38 89.51 94.38	et <b>SISA</b> BA 89.64 78.12 88.54 77.14 89.24 76.74	AS 24.7 82.2 0.0 80.3 0.0
Method AwoP MUECPA SSCSF	Table 19. 1 B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal	Unlear Fi 7A 92.86 89.32 93.24 90.54 94.72 91.18 80 24	ning F rst-Ord BA 89.74 79.14 88.15 77.46 89.42 77.18 89.42 89.42	Perform ler 25.56 82.15 0.00 83.12 0.00 82.45 0.00	mance Sec TA 92.74 89.61 93.14 90.12 94.54 91.34 90.14	on LI ond-Or BA 89.63 79.38 88.37 77.64 89.14 77.54 89.74	AMA der ASR 23.43 84.01 0.00 82.45 0.00 81.78 0.00	-3B w Un 7A 93.01 89.15 92.83 89.83 94.83 91.58 00.58	vith SS roll-SC BA 89.32 78.76 88.14 77.12 89.37 76.89 89.02	T-2 (2 D ASR 27.43 83.87 0.00 82.01 0.00 81.34 0.00	20% U <u>A</u> 92.68 88.43 92.45 89.24 94.92 91.41 91.12	nlearr mnesia BA 89.28 77.54 88.28 76.53 89.67 76.24 % \$2	ned) - tc ASR 29.34 83.23 0.00 81.23 0.00 80.78 0.00	TA 91.94 88.28 92.38 89.51 94.38 91.08 90.42	et <b>SISA</b> <b>BA</b> <b>89.64</b> 78.12 <b>88.54</b> 77.14 <b>89.24</b> 76.74 <b>89.67</b>	AS 24.7 82.3 0.0 80.3 0.0 80.3
Method AwoP MUECPA SSCSF BAU	Table 19. 1 B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	Unlear Fi TA 92.86 89.32 93.24 90.54 94.72 91.18 89.24	ning F rst-Ord BA 89.74 79.14 88.15 77.46 89.42 77.18 88.42 77.18	Perform er ASR 25.56 82.15 0.00 83.12 0.00 82.45 0.00 82.45	mance           Sec           TA           92.74           89.61           93.14           90.12           94.54           91.34           90.12           94.54           91.34           90.14	on LI ond-Or BA 89.63 79.38 88.37 77.64 89.14 77.54 88.74 77.54	AMA der ASR 23.43 84.01 0.00 82.45 0.00 81.78 0.00 81.78	-3B w U1 7A 93.01 89.15 92.83 89.83 94.83 91.58 90.58 90.58	vith SS roll-SC BA 89.32 78.76 88.14 77.12 89.37 76.89 88.92 76.52	T-2 (2 D ASR 27.43 83.87 0.00 82.01 0.00 81.34 0.00 81.34	20% U A 7A 92.68 88.43 92.45 89.24 94.92 91.41 91.12 86.02	nlearr mnesia BA 89.28 77.54 88.28 76.53 89.67 76.24 88.53 75.78	ned) - ic ASR 29.34 83.23 0.00 81.23 0.00 80.78 0.00 80.78 0.00	TA 91.94 88.28 92.38 89.51 94.38 91.08 90.42	et <b>SISA</b> <b>BA</b> <b>89.64</b> 78.12 <b>88.54</b> 77.14 <b>89.24</b> 76.24 <b>89.64</b> 77.14 <b>89.64</b> 77.14 <b>89.64</b> 77.14 <b>89.64</b> 77.14 76.24	AS 24. 82 0.0 80. 0.0 80. 0.0
Method AwoP MUECPA SSCSF BAU	Table 19. B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	Unlear Fi 7A 92.86 89.32 93.24 90.54 94.72 91.18 89.24 86.14 24.82	ning F rst-Ord BA 89.74 79.14 88.15 77.46 89.42 77.18 88.47 76.84 90.42	Perform ler 25.56 82.15 0.00 83.12 0.00 82.45 0.00 82.45 0.00 82.89	TA           92.74           89.61           93.14           90.12           94.54           91.34           90.12           94.54           91.34           90.12	on LI ond-Or BA 89.63 79.38 88.37 77.64 89.14 77.54 88.74 77.54 88.74 77.14 09.27	AMA der ASR 23.43 84.01 0.00 82.45 0.00 81.78 0.00 82.23 21.24	-3B w U1 7A 93.01 89.15 92.83 89.83 94.83 91.58 90.58 87.36	vith SS moll-SC BA 89.32 78.76 88.14 77.12 89.37 76.89 88.92 76.53	T-2 (2 D ASR 27.43 83.87 0.00 82.01 0.00 81.34 0.00 81.34 0.00 81.67	20% U <u>A</u> 92.68 88.43 92.45 89.24 94.92 91.41 91.12 86.92 94.21	nlearr mnesia BA 89.28 77.54 88.28 76.53 89.67 76.24 88.53 75.78	ned) - ne ASR 29.34 83.23 0.00 81.23 0.00 80.78 0.00 81.12 10.12	TA 91.94 88.28 92.38 89.51 94.38 91.08 90.42 86.48 94.28	et <b>SISA</b> 89.64 78.12 88.54 77.14 89.24 76.74 88.67 76.34 90.43	AS 24. 82. 0.0 80. 0.0 80. 80. 22
Method AwoP MUECPA SSCSF BAU UBA-Inf	Table 19. B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	Unlear Fi 7A 92.86 89.32 93.24 90.54 94.72 91.18 89.24 86.14 94.83 91.72	ning F rst-Ord BA 89.74 79.14 88.15 77.46 89.42 77.18 88.47 76.84 90.42 70.62	Perform ler 25.56 82.15 0.00 83.12 0.00 82.45 0.00 82.89 19.87 97.99	TA           92.74           89.61           93.14           90.12           94.54           91.34           90.12           94.54           91.34           90.12           94.54           91.34           90.12           94.94           91.14	on LI ond-Or BA 89.63 79.38 88.37 77.64 89.14 77.54 88.74 77.14 90.37	AMA der ASR 23.43 84.01 0.00 82.45 0.00 81.78 0.00 82.23 21.34 27.45 0.00	-3B w U1 TA 93.01 89.15 92.83 89.83 94.83 91.58 90.58 87.36 94.64	vith SS moll-SC BA 89.32 78.76 88.14 77.12 89.37 76.89 88.92 76.53 90.14 77.02	T-2 (2 D ASR 27.43 83.87 0.00 82.01 0.00 81.34 0.00 81.34 0.00 81.67 20.67 96 70	20% U <u>A</u> 92.68 88.43 92.45 89.24 94.92 91.41 91.12 86.92 94.31 90.69	nlearr mnesia BA 89.28 77.54 88.28 76.53 89.67 76.24 88.53 75.78 90.27 77.24	ned) - ne ASR 29.34 83.23 0.00 81.23 0.00 80.78 0.00 81.12 19.12 96.12	TA 91.94 88.28 92.38 89.51 94.38 91.08 90.42 86.48 94.28	et <b>SISA</b> 89.64 78.12 88.54 77.14 89.24 76.74 88.67 76.34 90.42 70.12	AS 24. 82. 0.0 80. 0.0 80. 22.
Method AwoP MUECPA SSCSF BAU UBA-Inf	Table 19. B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	Unlear TA 92.86 89.32 93.24 90.54 94.72 91.18 89.24 86.14 94.83 91.72	ning F rst-Ord BA 89.74 79.14 88.15 77.46 89.42 77.18 88.47 76.84 90.42 78.52 29.04	Perform ler 25.56 82.15 0.00 83.12 0.00 82.45 0.00 82.45 0.00 82.89 19.87 87.98	mance Sec TA 92.74 89.61 93.14 90.12 94.54 91.34 90.14 87.12 94.94 91.12 92.74	on LI ond-Or BA 89.63 79.38 88.37 77.64 89.14 77.54 88.74 77.14 90.37 78.74	AMA der ASR 23.43 84.01 0.00 82.45 0.00 81.78 0.00 82.23 21.34 87.45 0.00	-3B w Un 7A 93.01 89.15 92.83 89.83 94.83 91.58 90.58 87.36 94.64 91.23	vith SS roll-SC BA 89.32 78.76 88.14 77.12 89.37 76.89 88.92 76.53 90.14 77.93 90.74	T-2 (2 <b>D</b> ASR 27.43 83.87 0.00 82.01 0.00 81.34 0.00 81.67 20.67 86.78 0.00	20% U A 7A 92.68 88.43 92.45 89.24 94.92 91.41 91.12 86.92 94.31 90.68	nlearr mnesia BA 89.28 77.54 88.28 76.53 89.67 76.24 88.53 75.78 90.27 77.24	ned) - ac ASR 29.34 83.23 0.00 81.23 0.00 80.78 0.00 81.12 19.12 86.12 86.12	TA 91.94 88.28 92.38 89.51 94.38 91.08 90.42 86.48 94.28 90.14 90.14	et <b>SISA</b> <b>BA</b> <b>89.64</b> 78.12 <b>88.54</b> 77.14 <b>89.24</b> 76.74 <b>88.67</b> 76.34 90.42 78.12 78.12	AS 24. 82. 0.0 80. 0.0 80. 22. 85.
Method AwoP MUECPA SSCSF BAU UBA-Inf RMBMU	Table 19. 1 B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal	Unlear Fi 72.86 89.32 93.24 90.54 94.72 91.18 89.24 86.14 94.83 91.72 91.28 91.28	ning F rst-Ord BA 89.74 79.14 88.15 77.46 89.42 77.18 88.47 76.84 90.42 78.52 88.84	Perform ler 25.56 82.15 0.00 83.12 0.00 82.45 0.00 82.45 0.00 82.89 19.87 87.98 0.00	mance <u>Fac</u> 92.74 89.61 93.14 90.12 94.54 91.34 90.14 87.12 94.94 91.12 90.74 90.74	on LI ond-Or BA 89.63 79.38 88.37 77.64 89.14 77.54 88.74 77.14 90.37 78.74 89.14	AMA der ASR 23.43 84.01 0.00 82.45 0.00 81.78 0.00 82.23 21.34 87.45 0.00	-3B w Un 7A 93.01 89.15 92.83 89.83 94.83 91.58 90.58 87.36 94.64 91.23 91.12	vith SS roll-SC BA 89.32 78.76 88.14 77.12 89.37 76.89 88.92 76.53 90.14 77.93 88.76	T-2 (2 <b>A</b> SR 27.43 83.87 0.00 82.01 0.00 81.34 0.00 81.67 20.67 86.78 0.00	20% U TA 92.68 88.43 92.45 89.24 94.92 91.41 91.12 86.92 94.31 90.68 90.84 90.84	nlearr BA 89.28 77.54 88.28 76.53 89.67 76.24 88.53 75.78 90.27 77.24 88.54	ned) - <b>E</b> 29.34 83.23 0.00 81.23 0.00 80.78 0.00 81.12 19.12 86.12 0.00 0.00 0.00	TA 91.94 88.28 92.38 89.51 94.38 91.08 90.42 86.48 94.28 90.14 90.32	et <b>SISA</b> 89.64 78.12 88.54 77.14 89.24 76.74 88.67 76.34 90.42 78.12 88.74 76.34	A3 24 82 0. 80 0. 80 0. 80 22 85 0.
Method AwoP MUECPA SSCSF BAU UBA-Inf RMBMU	Table 19. 1 B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	Unlear Fi 7A 92.86 89.32 93.24 90.54 94.72 91.18 89.24 86.14 94.83 91.72 91.28 89.23	ning H rst-Ord BA 89.74 79.14 88.15 77.46 89.42 77.18 88.47 76.84 90.42 78.52 88.84 77.32	Perform ASR 25.56 82.15 0.00 83.12 0.00 82.45 0.00 82.89 19.87 87.98 0.00 84.23	nance           Sec           TA           92.74           89.61           93.14           90.12           94.54           90.14           87.12           94.94           91.12           90.74           88.84	on LI ond-Or BA 89.63 79.38 88.37 77.64 89.14 77.54 88.74 90.37 78.74 89.14 77.74 90.37	AMA der ASR 23.43 84.01 0.00 82.45 0.00 81.78 0.00 82.23 21.34 87.45 0.00 83.89	-3B w TA 93.01 89.15 92.83 89.83 94.83 90.58 90.58 87.36 94.64 91.23 91.12 88.58	vith SS roll-SC BA 89.32 78.76 88.14 77.12 89.37 76.89 88.92 76.53 90.14 77.93 88.76 77.18	T-2 (2 <b>D</b> ASR 27.43 83.87 0.00 82.01 0.00 81.34 0.00 81.67 20.67 86.78 0.00 83.12	20% U TA 92.68 88.43 92.45 89.24 94.92 91.41 91.12 86.92 94.31 90.68 90.84 88.41 80.61 90.84	nlearr mnesia 89.28 77.54 88.28 76.53 89.67 76.24 88.53 75.78 90.27 77.24 88.54 76.57	ned) - nc 29.34 83.23 0.00 81.23 0.00 80.78 0.00 81.12 19.12 86.12 0.00 82.78	TA 91.94 88.28 92.38 89.51 94.38 90.42 86.48 90.42 86.48 90.14 90.32 88.28	et <b>SISA</b> 89.64 78.12 88.54 77.14 89.24 76.34 90.42 76.34 90.42 78.12 88.74 76.34 90.42 78.12	A3 24 82 0. 80 0. 80 0. 80 22 85 0. 82
Method AwoP MUECPA SSCSF BAU UBA-Inf RMBMU DABF	Table 19. B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal	Unlear Fi 7A 92.86 89.32 93.24 90.54 94.72 91.18 89.24 86.14 94.83 91.72 91.28 89.23 91.64	ning F rst-Ord BA 89.74 79.14 88.15 77.46 89.42 77.18 88.47 76.84 90.42 78.52 88.84 77.32 89.14	Perform ler 25.56 82.15 0.00 83.12 0.00 82.45 0.00 82.89 19.87 87.98 0.00 84.23 8.34	nance           TA           92.74           89.61           93.14           90.12           94.54           90.14           87.12           94.94           91.12           90.74           88.84           91.32	on LI ond-Or BA 89.63 79.38 88.37 77.64 89.14 77.54 88.74 77.54 88.74 77.14 90.37 78.74 89.14 77.64 89.14 77.64 89.28	AMA der ASR 23.43 84.01 0.00 82.45 0.00 81.78 0.00 82.23 21.34 87.45 0.00 83.89 14.56	-3B w TA 93.01 89.15 92.83 94.83 91.58 90.58 87.36 94.64 91.23 91.12 88.58 91.13	vith SS roll-SC BA 89.32 78.76 88.14 77.12 89.37 76.89 88.92 76.53 90.14 77.93 88.76 77.18 89.12	T-2 (2 ASR 27.43 83.87 0.00 82.01 0.00 81.34 0.00 81.67 20.67 86.78 0.00 83.12 11.23	20% U TA 92.68 88.43 92.45 89.24 94.92 91.41 91.12 86.92 94.31 90.68 90.84 88.41 91.84	nlearr mnesia 89.28 77.54 88.28 76.53 89.67 76.24 88.53 75.78 90.27 77.24 88.54 76.57 89.42	ned) - ac 29.34 83.23 0.00 81.23 0.00 80.78 0.00 81.12 19.12 86.12 0.00 82.78 10.12	TA 91.94 88.28 92.38 89.51 94.38 90.42 86.48 90.14 90.32 88.28 91.57	et <b>SISA</b> 89.64 78.12 88.54 77.14 89.24 76.74 88.67 76.34 90.42 78.12 88.74 76.84 89.31	A3 24 82 0. 80 0. 80 0. 80 22 85 0. 82 9.
Method AwoP MUECPA SSCSF BAU UBA-Inf RMBMU DABF	Table 19.         B/A Unlearn         Conceal         Unlearn	Unlear Fi 72 92.86 89.32 93.24 90.54 94.72 91.18 89.24 86.14 94.83 91.72 91.28 89.23 91.64 88.84	ning F rst-Ord BA 89.74 79.14 88.15 77.46 89.42 77.18 88.47 76.84 90.42 78.52 88.84 77.32 88.84 77.32	Perform Ier 25.56 82.15 0.00 83.12 0.00 82.45 0.00 82.89 19.87 87.98 0.00 84.23 8.34 81.67	Sec           TA           92.74           89.61           93.14           90.12           94.54           91.34           90.14           87.12           94.94           91.32           90.72           90.74	on LI ond-Or BA 89.63 79.38 88.37 77.64 89.14 77.54 88.74 77.14 90.37 78.74 89.14 77.64 89.14 77.64 89.28 77.54	AMA der ASR 23.43 84.01 0.00 82.45 0.00 81.78 0.00 82.23 21.34 87.45 0.00 83.89 14.56 80.98	-3B w Un 7A 93.01 89.15 92.83 89.83 94.83 91.58 90.58 87.36 94.64 91.23 91.12 88.58 91.43 88.31	vith SS roll-SC BA 89.32 78.76 88.14 77.12 89.37 76.89 88.92 76.53 90.14 77.93 88.76 77.18 88.76 77.18 89.12 76.94	T-2 (2 <b>D</b> ASR 27.43 83.87 0.00 82.01 0.00 81.34 0.00 81.67 20.67 86.78 0.00 83.12 11.23 80.34	20% U A 92.68 88.43 92.45 89.24 94.92 91.41 91.12 86.92 94.31 90.68 90.84 88.41 91.84 88.12	nlearr mesia 89.28 77.54 88.28 76.53 89.67 76.24 88.53 75.78 90.27 77.24 88.54 76.57 89.42 76.43	ned) - ic ASR 29.34 83.23 0.00 81.23 0.00 80.78 0.00 81.12 19.12 86.12 0.00 82.78 10.12 79.89	TA 91.94 88.28 92.38 89.51 94.38 91.08 90.42 86.48 90.42 86.48 90.14 90.32 88.28 91.57 88.24	et <b>SISA</b> <b>BA</b> <b>89.64</b> 78.12 88.54 77.14 89.24 76.74 88.67 76.34 90.42 78.12 88.74 76.34 90.42 78.12 88.74 76.34 90.42 78.12 88.74 76.34 90.42 78.72 76.34 90.42 78.72 76.34 90.42 78.72 76.34 90.42 78.72 76.34 90.42 78.72 76.34 90.42 78.72 76.34 90.42 77.74 88.76 76.34 90.42 78.72 88.76 76.34 90.42 78.72 88.74 76.34 90.42 78.72 88.74 76.34 90.42 78.72 88.74 76.34 90.42 78.72 88.74 76.34 76.74 77.74 77.74 77.74 77.74 77.74 77.74 77.	A3 24 82 0. 80 0. 80 22 85 0. 82 9. 79
Method AwoP MUECPA SSCSF BAU UBA-Inf RMBMU DABF AdvIIA	Table 19. B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	Unlear TA 92.86 89.32 93.24 94.72 91.18 89.24 86.14 94.83 91.72 91.28 89.23 91.64 88.84 90.12	ning F rst-Ord BA 89.74 79.14 88.15 77.46 89.42 77.18 88.47 76.84 90.42 78.52 88.84 77.32 88.84 77.32 89.14 77.14 88.43	Perform ASR 25.56 82.15 0.00 83.12 0.00 82.45 0.00 82.89 19.87 87.98 0.00 84.23 8.34 81.67 0.00	nance           TA           92.74           89.61           93.14           90.12           94.54           91.34           90.14           87.12           94.94           91.12           90.74           88.84           91.32           88.42           90.34	on LI ond-Or BA 89.63 79.38 88.37 77.64 89.14 77.54 88.74 77.14 90.37 78.74 89.14 77.64 89.14 77.64 89.14 77.64 89.28 77.54 88.57	AMA der 23.43 84.01 0.00 82.45 0.00 81.78 0.00 82.23 21.34 87.45 0.00 83.89 14.56 80.98 0.00	-3B w Un 7A 93.01 89.15 92.83 89.83 94.83 91.58 90.58 87.36 94.64 91.23 91.12 88.58 91.43 88.31 90.64	vith SS roll-SC BA 89.32 78.76 88.14 77.12 89.37 76.89 88.92 76.53 90.14 77.93 88.76 77.18 89.12 76.94 88.74	T-2 (2 D ASR 27.43 83.87 0.00 81.34 0.00 81.34 0.00 81.67 20.67 86.78 0.00 83.12 11.23 80.34 0.00	20% U A 92.68 88.43 92.45 89.24 94.92 91.41 91.12 86.92 94.31 90.68 90.84 88.41 91.84 88.12 90.84	nlearr mesia 89.28 77.54 88.28 76.54 88.28 76.24 88.53 75.78 90.27 77.24 88.54 76.57 89.42 76.43 88.62	ned) - kc 29.34 83.23 0.00 81.23 0.00 81.12 19.12 86.12 0.00 82.78 10.12 79.89 0.00	TA 91.94 88.28 92.38 89.51 94.38 91.08 90.42 86.48 90.14 90.32 88.28 891.57 88.24 90.74	et <b>SISA</b> 89.64 78.12 88.54 77.14 89.24 76.74 88.67 76.34 90.42 78.12 88.74 76.34 90.42 78.12 88.74 76.34 89.31 76.74 88.42	A3 24 82 0. 80 0. 80 0. 80 22 85 0. 82 9. 79 0.
Method AwoP MUECPA SSCSF BAU UBA-Inf RMBMU DABF AdvUA	Table 19. B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	Unlear Fi 7A 92.86 89.32 93.24 90.54 94.72 91.18 89.24 86.14 94.83 91.72 91.28 89.23 91.28 89.23 91.28 88.84 90.12 87.42	ning F rst-Ord BA 89.74 79.14 88.15 77.46 89.42 77.18 888.47 76.84 90.42 78.52 88.84 77.52 88.84 77.32 89.14 88.43 76.84	Perform ler 25.56 82.15 0.00 82.45 0.00 82.45 0.00 82.89 19.87 87.98 0.00 84.23 8.34 81.67 0.00 80.98	nance           Sec           TA           92.74           89.61           93.14           90.12           94.54           91.34           90.14           87.12           94.94           91.12           90.74           88.84           91.32           90.34           88.42           90.34           87.12	on LI ond-Or BA 89.63 79.38 88.37 77.64 89.14 77.54 88.74 77.14 90.37 78.74 89.14 77.64 89.14 77.64 89.28 77.54 88.57 77.14	AMA der ASR 23.43 84.01 0.00 82.45 0.00 81.78 0.00 82.23 21.34 87.45 0.00 83.89 14.56 80.98 0.00 80.12	-3B w TA 93.01 89.15 92.83 94.83 94.83 91.58 87.36 94.64 91.23 91.12 88.58 91.43 89.13 89.14 88.31 90.64 87.18	vith SS roll-SC BA 89.32 78.76 88.14 77.12 89.37 76.89 88.92 76.53 90.14 77.93 88.76 77.93 88.76 77.18 89.12 76.94 88.74 76.34	T-2 (2 D ASR 27.43 83.87 0.00 81.34 0.00 81.34 0.00 81.34 0.00 81.34 0.00 81.34 0.00 81.34 0.00 83.12 11.23 80.34 0.00 79.78	20% U A 92.68 88.43 92.45 89.24 94.92 91.41 91.12 86.92 94.31 90.68 90.84 88.41 91.84 88.12 90.84 86.84	nlearr mesia 89.28 77.54 88.28 76.53 89.67 76.24 88.53 75.78 90.27 77.24 88.54 76.57 89.62 76.43 88.62 75.78	ned) - nc ASR 29.34 83.23 0.00 81.23 0.00 81.12 19.12 86.12 0.00 82.78 10.12 79.89 0.00 79.12	TA 91.94 88.28 92.38 89.51 94.38 91.08 90.42 86.48 90.42 86.48 90.14 90.32 88.28 91.57 88.24 90.74 86.94	et <b>SISA</b> 89.64 78.12 88.54 77.14 89.24 76.74 88.67 76.34 90.42 78.12 88.74 76.34 90.42 78.12 88.74 76.34 89.31 76.74 88.54 76.31 89.54 76.34 89.54 76.74 88.54 76.75 76.7	A3 24 82 0. 80 0. 80 0. 80 22 85 0. 82 9. 79 0. 78
Method AwoP MUECPA SSCSF BAU UBA-Inf RMBMU DABF AdvUA	Table 19. 1 B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	Unlear Fi TA 92.86 89.32 93.24 90.54 94.72 91.18 89.24 86.14 94.83 91.72 91.28 89.23 91.64 88.84 90.12 87.42 92.84	ning F rst-Ord BA 89.74 79.14 88.15 77.46 89.42 77.18 88.47 76.84 90.42 78.52 88.84 77.32 89.14 77.14 88.43 76.84 89.74	Perform er 25.56 82.15 0.00 83.12 0.00 82.49 19.87 87.98 0.00 84.23 8.34 81.67 0.00 80.98 12.34	nance           TA           92.74           89.61           93.14           90.12           94.54           91.34           90.14           87.12           90.74           88.84           91.32           88.42           90.34           87.12           90.34	on LI ond-Or BA 89.63 79.38 88.37 77.64 89.14 77.54 88.74 77.14 90.37 78.74 89.14 77.64 89.14 77.64 89.28 77.54 88.57 77.14 89.32	AMA der ASR 23.43 84.01 0.00 82.45 0.00 81.78 0.00 82.23 21.34 87.45 0.00 83.89 14.56 80.98 0.00 80.12 14.78	-3B w TA 93.01 89.15 92.83 94.83 91.58 90.58 87.36 94.64 91.23 91.12 88.58 91.43 88.31 90.64	vith SS roll-SC BA 89.32 78.76 88.14 77.12 89.37 76.89 88.92 76.53 90.14 77.93 88.76 77.18 89.12 76.94 88.74 76.34 89.14	T-2 (2 D ASR 27.43 83.87 0.00 81.01 0.00 81.34 0.00 81.67 20.67 86.78 0.00 83.12 11.23 80.34 0.00 79.78 11.23	20% U A TA 92.68 88.43 92.45 89.24 94.92 91.41 91.12 86.92 94.31 90.68 90.84 88.41 91.84 88.12 90.84 86.84 92.84	nlearr mnesia 89.28 77.54 88.28 87.53 89.67 76.24 88.53 75.78 90.27 77.24 88.54 76.57 89.42 76.43 88.62 75.78 89.42	ned) - ac ASR 29.34 83.23 0.00 81.23 0.00 80.78 0.00 81.12 19.12 86.12 0.00 82.78 10.12 79.89 0.00 79.12 12.89	TA 91.94 88.28 92.38 89.51 94.38 91.08 90.42 86.48 94.28 90.14 90.32 88.28 91.57 88.24 90.74 86.94 90.74	et <b>SISA</b> 89.64 78.12 88.54 77.14 89.24 76.74 88.67 76.34 90.42 78.12 88.74 76.84 89.31 76.74 88.74 76.84 89.31 76.74 88.54 89.64	A3 24 82 0.4 80 0.4 80 0.4 80 22 85 0.4 82 9.79 0.4 78 14
Method AwoP MUECPA SSCSF BAU UBA-Inf RMBMU DABF AdvUA EVMUS	Table 19. B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	Unlear Fi 7A 92.86 89.32 93.24 90.54 94.72 91.18 89.24 86.14 94.83 91.72 91.28 89.23 91.64 88.84 90.12 87.42 92.84 90.12	ning F rst-Ord BA 89.74 79.14 88.15 77.46 89.42 77.18 88.47 76.84 90.42 78.52 88.84 77.32 88.84 77.32 89.14 77.14 88.43 76.84 89.74 79.14	Perform Ier 25.56 82.15 0.00 83.12 0.00 82.45 0.00 82.89 19.87 87.98 0.00 84.23 8.34 81.67 0.00 80.98 12.34 79.67	Sec           TA           92.74           89.61           93.14           90.12           94.54           91.34           90.14           87.12           94.74           88.84           91.32           88.84           91.32           88.42           90.34           87.12           92.43           89.84	on LI ond-Or BA 89.63 79.38 88.37 77.64 89.14 77.54 88.74 77.14 90.37 78.74 89.14 77.64 89.14 77.64 89.28 77.54 88.75 77.14 89.32 79.54	AMA der ASR 23.43 84.01 0.00 82.45 0.00 81.78 0.00 82.23 21.34 87.45 0.00 83.89 14.56 80.98 0.00 80.98 0.00 80.12 14.78 79.34	-3B w Un TA 93.01 89.15 92.83 94.83 91.58 90.58 87.36 94.64 91.23 88.58 91.43 88.31 90.64 87.18 92.64 89.68	vith SS roll-SC BA 89.32 78.76 88.14 77.12 89.37 76.89 88.92 76.53 90.14 77.93 88.76 77.18 89.12 76.94 88.74 76.34 89.14 76.34	T-2 (2 D ASR 27.43 83.87 0.00 81.34 0.00 81.34 0.00 81.67 86.78 0.00 83.12 11.23 80.34 0.00 79.78 81.23 11.23 78.89	20% U A 72 92.68 88.43 92.45 89.24 94.92 91.41 91.12 86.92 94.31 90.84 88.41 91.84 88.12 90.84 88.12 90.84 86.84 92.84 86.84 88.74	nlearr mnesia 89.28 77.54 88.28 76.53 89.67 76.24 88.53 75.78 90.27 77.24 88.54 76.57 89.42 76.43 88.62 75.78 89.42 75.78	ned) - kc ASR 29.34 83.23 0.00 81.23 0.00 80.78 0.00 81.12 19.12 86.12 0.00 82.78 10.12 79.89 0.00 79.12 12.89 78.34	TA 91.94 88.28 92.38 89.51 94.38 91.08 90.42 86.48 90.14 90.32 88.28 90.14 90.32 88.28 91.57 88.24 90.57 88.24 90.57 88.24 90.54 86.94 86.94	et <b>SISA</b> 89.64 78.12 88.54 77.14 89.24 76.74 88.67 76.34 90.42 78.12 88.74 76.84 89.31 76.74 88.74 76.84 89.31 76.74 88.964 78.43	A3 24 82 0. 80 0. 80 0. 80 22 85 0. 82 9. 79 0. 78 14 77
Method AwoP MUECPA SSCSF BAU UBA-Inf RMBMU DABF AdvUA EVMUS	Table 19.         B/A Unlearn         Conceal         Unlearn	Unlear Fi 7A 92.86 89.32 93.24 90.54 94.72 91.18 89.24 86.14 94.72 91.18 89.24 89.23 91.64 88.84 90.12 87.42 92.84 90.12 95.14	ning F rst-Ord BA 89.74 79.14 88.15 77.46 89.42 77.18 88.47 76.84 90.42 78.52 88.84 77.32 89.14 77.14 88.43 76.84 89.74 79.14 90.118	Perform er 25.56 82.15 0.00 83.12 0.00 82.45 0.00 82.89 19.87 87.98 0.00 84.23 8.34 81.67 0.00 84.23 8.34 81.67 0.00 84.23 8.34 81.67 0.00 84.23 8.34 81.67 0.00 84.23 8.34 81.67 0.00 84.23 8.34 81.67 0.00 84.23 8.34 81.67 0.00 84.23 8.34 81.67 0.00 84.23 8.34 81.67 0.00 84.23 8.34 81.67 0.00 84.23 8.34 81.67 0.00 84.23 8.34 81.67 0.00 84.23 8.34 81.67 0.00 84.23 8.34 81.67 0.00 84.23 8.34 81.67 0.00 84.23 8.34 81.67 0.00 84.23 8.34 81.67 0.00 80.00 84.23 8.34 81.67 0.00 80.00 80.00 84.23 8.34 81.67 0.00 80.000 80.000 80.000 80.0000 80.000 80.0	Sec           TA           92.74           89.61           93.14           90.12           94.54           91.34           90.14           87.12           94.74           88.84           91.32           88.84           91.32           88.42           90.34           87.12           92.43           89.84           94.74	on LI ond-Or BA 89.63 79.38 88.37 77.64 89.14 77.54 88.74 77.14 89.14 77.54 89.14 77.64 89.14 77.54 89.14 77.54 89.57 77.14 89.53 91.54	AMA der ASR 23.43 84.01 0.00 82.43 0.00 81.78 0.00 82.23 21.34 87.45 0.00 83.89 14.56 80.98 0.00 80.12 14.78 79.34 0.00	-3B w Un 7A 93.01 89.15 92.83 89.83 91.58 90.58 87.36 94.83 91.58 91.58 91.23 88.58 91.23 88.31 90.64 87.18 92.64 89.68 95.32	vith SS roll-SC BA 89.32 78.76 88.14 77.12 89.37 76.89 88.92 76.53 90.14 77.93 88.76 77.18 89.12 76.94 88.74 76.94 88.74 76.94 88.74 76.94 88.74 76.94 88.74 76.94 88.74 76.94 89.14 78.76 91.32	T-2 (2 D ASR 27.43 83.87 0.00 81.34 0.00 81.34 0.00 81.67 20.67 86.78 0.00 83.12 11.23 80.34 0.00 79.78 80.34 0.00	20% U A 92.68 88.43 92.45 89.245 89.245 89.245 91.41 91.12 86.92 94.31 90.84 88.41 91.84 88.12 90.84 88.41 91.84 88.84 92.84 92.84 88.74 95.02	nlearr mnesia BA 89.28 77.54 88.28 76.53 89.67 76.24 88.53 75.78 90.27 77.24 88.54 76.57 89.42 76.43 88.62 75.78 89.42 76.43 88.62 75.78 89.42 77.84 99.114	ned) - kc 29.34 83.23 0.00 81.23 0.00 80.78 0.00 81.12 19.12 86.12 0.00 82.78 10.12 79.89 0.00 82.78 10.12 79.89 0.00 79.12 12.89 78.34 0.00	TA 91.94 88.28 92.38 89.51 94.38 91.08 90.42 86.48 90.42 80.42 90.42 80.42 90.32 88.28 91.57 88.24 90.74 86.94 92.32 89.24 92.32	et <b>SISA</b> <b>BA</b> <b>89.64</b> 78.12 88.54 77.14 89.24 76.74 88.67 76.34 90.42 78.12 88.74 76.84 89.31 76.74 88.42 76.18 89.64 78.43 91.43	A3 24 82 0.1 80 0.1 80 0.2 85 0.1 82 9 79 0.1 78 14 77 0.1
Method AwoP MUECPA SSCSF BAU UBA-Inf RMBMU DABF AdvUA EVMUS DDPA	Table 19. B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	Unlear Fi 7A 92.86 89.32 93.24 90.54 94.72 91.18 89.24 86.14 94.83 91.72 91.28 89.23 91.64 88.84 90.12 87.42 92.84 90.12 95.14 91.24	ning F rst-Ord BA 89.74 79.14 88.15 77.46 89.42 77.18 88.47 76.84 90.42 78.52 88.84 77.32 88.84 77.14 88.43 76.84 89.74 79.14 88.43 76.84 89.74 79.14 88.43 76.84 89.74 79.14 88.43 76.84 89.74 79.14 88.43 76.84 89.74 71.14 88.43 76.84 89.74 71.14 88.43 76.84 89.74 71.14 88.43 76.84 90.42 77.14 88.43 76.84 97.14 88.43 77.14 88.43 76.84 97.14 88.43 77.14 88.43 77.14 88.43 76.84 97.14 88.43 77.14 88.43 76.84 97.14 88.43 76.84 89.42 77.14 88.43 76.84 89.42 77.14 88.43 76.84 97.14 87.42 78.52 89.14 77.14 88.43 76.84	Perform Ier 25.56 82.15 0.00 83.12 0.00 82.45 0.00 82.89 19.87 87.98 0.00 84.23 8.34 81.67 0.00 84.23 8.34 81.67 0.00 84.23 8.34 81.67 0.00 84.23 8.34 81.67 0.00 84.23 8.34 8.35 8.34 8.35 8.35 8.35 8.35 8.35 8.35	nance           Sec           TA           92.74           89.61           93.14           90.12           94.54           91.34           90.14           87.12           90.74           88.84           91.32           88.42           90.34           87.12           92.34           87.12           92.34           87.12           92.34           89.84           94.74           91.38	on LI ond-Or BA 89.63 79.38 88.37 77.64 89.14 77.54 88.74 77.14 90.37 78.74 89.14 77.64 89.14 89.28 77.54 88.57 77.14 89.32 79.54 91.54 77.18	AMA der ASR 23.43 84.01 0.00 82.45 0.00 82.23 21.34 87.45 0.00 83.89 14.56 80.98 0.00 83.89 14.56 80.98 0.00 83.12 14.78 79.34 0.00 89.12	-3B w Un 7A 93.01 89.15 92.83 89.83 91.58 90.58 87.36 94.64 91.23 91.12 88.58 91.43 88.31 90.64 87.18 92.64 89.64 89.532 90.94	vith SS roll-SC BA 89.32 78.76 88.14 77.12 89.37 76.89 88.92 76.53 90.14 77.93 88.76 77.18 89.12 76.94 88.74 76.34 89.12 76.94 88.74 76.34 89.12 76.34 89.12 76.34 89.12 76.34 89.12 76.34 89.12 75.74	T-2 (2 D ASR 27.43 83.87 0.00 81.34 0.00 81.34 0.00 81.67 20.67 86.78 0.00 83.12 11.23 80.34 0.00 79.78 11.23 80.34 0.00 83.45	20% U A 92.68 88.43 92.45 89.24 94.92 91.41 91.12 86.92 94.31 90.68 90.84 88.41 91.84 88.12 90.84 88.84 90.84 88.84 92.84 90.84 88.74 95.02 90.28	nlearr mesia BA 89.28 77.54 88.28 76.54 88.63 75.78 90.27 77.24 88.54 76.57 89.42 76.43 88.62 75.78 89.42 76.43 88.62 75.78 89.42 77.84 91.14 75.32	ned) - kc ASR 29.34 83.23 0.00 81.23 0.00 81.22 19.12 86.12 0.00 82.78 10.12 79.89 0.00 79.12 12.89 0.00 79.12 12.834 0.00 87.89	TA 91.94 88.28 92.38 89.51 94.38 91.08 90.42 86.48 90.42 86.48 90.14 90.32 88.28 91.57 88.24 90.74 86.94 90.74 86.94 92.32 89.24 95.14 90.54	et <b>SISA</b> <b>BA</b> <b>89.64</b> 78.12 88.54 77.14 89.24 76.74 88.67 76.34 90.42 78.12 88.74 76.34 90.42 78.12 88.74 76.34 90.42 78.12 88.74 76.34 90.42 76.34 90.42 78.12 88.74 76.34 90.42 78.12 88.74 76.34 90.42 78.12 88.74 76.34 90.42 78.12 88.74 76.34 90.42 78.12 88.74 76.34 90.42 78.12 88.74 76.34 90.42 78.12 88.74 76.34 90.42 78.12 88.74 76.34 90.42 76.74 88.74 76.74 88.74 76.34 90.42 76.74 88.74 76.34 90.42 76.74 88.74 76.74 88.74 76.34 90.42 76.74 88.74 76.74 88.74 76.74 88.74 76.34 90.42 76.74 88.74 76.74 88.74 76.74 88.74 76.74 88.74 76.74 88.74 76.74 88.74 76.74 88.74 76.74 88.74 76.74 88.74 76.74 88.74 76.74 88.74 76.74 88.74 76.74 88.74 76.74 88.74 76.74 89.31 76.74 89.74 78.74 76.74 78.74 76.74 77.74 77.74 77.74 77.74 77.74 77.74 77.	A3 24 82 0. 80 0. 80 0. 80 22 85 0. 82 9. 79 0. 82 9. 79 0. 82 85 14 77 0. 87
Method AwoP MUECPA SSCSF BAU UBA-Inf RMBMU DABF AdvUA EVMUS DDPA	Table 19. B/A Unlearn Conceal Unlearn	Unlear Fi 7A 92.86 89.32 93.24 90.54 94.72 91.18 89.24 86.14 94.83 91.72 91.28 89.23 91.64 88.84 90.12 87.42 92.84 90.12 95.14 91.24 94.12	ning F rst-Ord BA 89.74 79.14 88.15 77.46 89.42 77.18 88.47 76.84 90.42 78.52 88.84 77.32 88.84 77.32 89.14 77.14 88.43 76.84 89.74 79.14 88.43 76.84 89.74 79.14 88.43 76.84 89.74 79.14 88.43 76.84 89.74 70.14 88.43 76.84 89.74 70.14 88.43 76.84 89.74 70.14 88.43 76.84 89.74 70.14 88.43 76.84 89.74 70.14 88.43 77.14 88.43 76.84 89.74 77.14 88.43 77.14 88.43 76.84 89.74 77.14 88.43 77.14 88.43 77.14 88.43 77.14 88.43 77.14 88.43 77.14 88.43 77.14 88.43 77.14 88.43 77.14 88.43 77.14 88.43 77.14 88.43 77.14 88.43 76.84 89.74 77.14 88.43 77.14 88.43 77.14 88.43 77.14 88.43 77.14 88.43 77.14 88.43 77.14 88.43 77.14 88.43 77.14 88.43 77.14 88.43 77.14 88.43 76.84 89.74 77.14 88.43 76.84 89.74 77.14 88.43 76.84 89.74 77.14 88.43 76.84 89.74 77.14 88.43 76.84 89.74 77.14 88.43 76.84 89.74 77.32	Perform er ASR 25.56 82.15 0.00 83.12 0.00 82.45 0.00 82.45 0.00 82.89 19.87 87.98 0.00 84.23 8.34 81.67 0.00 84.23 8.34 81.67 0.00 80.98 12.34 79.67 0.00 89.78 0.00	nance           TA           92.74           89.61           93.14           90.12           94.54           91.34           90.14           87.12           94.94           91.12           90.74           88.84           91.32           88.42           90.34           87.12           92.43           89.84           94.74           91.38           93.98	on LI ond-Or BA 89.63 79.38 88.37 77.64 89.14 77.54 88.74 77.14 90.37 78.74 89.14 77.64 89.14 77.64 89.14 77.64 89.22 79.54 91.54 89.32	AMA der ASR 23.43 84.01 0.00 82.45 0.00 82.23 21.34 87.45 0.00 83.89 14.56 80.98 0.00 80.12 14.78 79.34 0.00 89.12 0.00	-3B w Un 7A 93.01 89.15 92.83 89.83 94.83 91.58 90.58 87.36 94.64 91.23 91.12 88.58 91.43 88.31 90.64 87.18 92.64 89.68 95.32 90.94 94.21	vith SS roll-SC BA 89.32 78.76 88.14 77.76 89.37 76.89 88.92 76.53 90.14 77.93 88.76 77.18 89.12 76.94 88.74 76.34 89.14 78.76 91.32 75.74 90.27	T-2 (2 D ASR 27.43 83.87 0.00 81.34 0.00 81.34 0.00 81.34 0.00 81.34 0.00 81.34 0.00 81.123 80.34 0.00 79.78 81.23 80.34 0.00 79.78 81.23 80.34 0.00 79.78 81.23 80.34 0.00 79.78 81.23 80.34 0.00 79.78 81.23 80.34 0.00 79.78 81.23 80.34 0.00 79.78 81.23 78.89 0.00 78.89 78.95 79.05 78.95 78.95 78.95 79.05 78.95 79.05 78.95 79.05 78.95 79.05 78.95 79.05 70.05 78.95 70.05 78.95 70.05 78.95 70.05 78.95 70.05 78.95 70.05 78.95 70.05 78.95 70.05 78.95 70.05 78.95 70.05	20% U A 92.68 88.43 92.45 89.24 94.92 91.41 91.12 86.92 94.31 90.68 90.84 88.41 90.84 88.12 90.84 88.12 90.84 88.12 90.84 88.74 95.02 90.28 94.32	nlearr mesia BA 89.28 77.54 88.28 76.54 88.53 75.78 90.27 77.24 88.53 75.78 90.27 77.24 88.54 76.43 88.62 75.78 89.42 76.78 76.24 76.24 76.24 76.24 77.54 77.54 77.54 77.54 77.54 88.53 75.78 89.42 76.78 76.24 76.24 88.53 76.78 76.24 77.54 76.24 76.32 76.24 76.32 76.24 76.32 76.32 77.24 88.52 77.24 88.52 75.78 89.42 75.78 89.42 75.78 89.42 75.78	ned) - kc 29.34 83.23 0.00 81.23 0.00 81.12 19.12 86.12 0.00 82.78 10.12 79.89 0.00 79.12 12.89 78.34 0.00 87.89 0.00	TA 91.94 88.28 92.38 89.51 94.38 91.08 90.42 86.48 90.42 86.48 90.14 90.32 88.28 891.57 88.24 90.74 86.94 90.74 86.94 92.32 89.24 95.14 90.54 94.04	et <b>SISA</b> 89.64 78.12 88.54 77.14 89.24 76.74 88.67 76.34 90.42 78.12 88.74 76.34 90.42 78.12 88.74 76.34 89.64 76.74 88.42 76.18 89.64 78.43 91.43 90.24 90.24	AS 24. 82. 0.0 80. 0.0 80. 22. 85. 0.0 82. 9.4 79. 0.0 78. 14. 77. 0.0 87. 0.0
Method AwoP MUECPA SSCSF BAU UBA-Inf RMBMU DABF AdvUA EVMUS DDPA	Table 19. B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	Unlear Fi 7A 92.86 89.32 93.24 90.54 94.72 91.18 89.24 86.14 94.83 91.72 91.28 89.23 91.28 89.23 91.28 89.23 91.28 89.23 91.28 89.23 91.28 89.24 90.51 91.28 89.23 91.28 89.23 91.28 89.23 91.28 89.24 90.54 91.28 89.24 90.54 91.28 89.24 90.54 91.28 89.24 91.28 89.24 91.28 89.24 91.28 89.24 91.28 89.24 91.28 89.24 91.28 89.24 91.28 89.24 91.28 89.24 91.28 89.24 91.28 89.24 91.28 89.24 91.28 89.24 91.28 89.23 91.28 89.23 91.28 89.23 91.28 89.24 90.51 91.28 89.23 91.28 89.24 90.54 90.54 91.28 91.28 89.23 91.28 90.54 90.54 90.52 91.28 90.54 90.55 90.54 90.54 90.54 90.55	ning F rst-Ord BA 89.74 79.14 88.15 77.46 89.42 77.18 88.47 76.84 90.42 78.52 88.84 77.52 88.84 77.32 89.44 77.14 88.43 76.84 89.74 77.14 88.43 76.84 89.74 77.14 88.43 76.84 89.74 77.14 88.75 77.14 88.74 77.14 88.75 77.14 88.47 77.18 87.75 77.75 87.75 87.75 87.75 77.75 87.75 87.75 77.75 87.75 77.75 87.75 77.75 87.75 77.75 87.75 77.75 87.75 77.75 87.75 77.75 87.75 77.75 87.75 77.75 87.75 77.75 87.75 77.75 87.75 77.75	Perform er 25.56 82.15 0.00 82.45 0.00 82.89 19.87 87.98 0.00 84.23 8.34 81.67 0.00 80.98 12.34 79.67 0.00 89.78 0.00 89.78 0.00 89.78 0.00 80.98 12.34 13.34	nance           Sec           TA           92.74           89.61           93.14           90.12           94.54           91.34           90.14           87.12           94.94           91.12           90.74           88.82           90.34           87.12           92.43           89.84           91.38           93.98           90.14	on LI ond-Or BA 89.63 79.38 88.37 77.64 89.14 77.54 88.74 77.14 90.37 78.74 89.14 77.64 89.14 77.64 89.22 79.54 88.57 77.14 89.32 79.54 90.43 90.43 97.84	AMA der ASR 23.43 84.01 0.00 82.45 0.00 81.78 0.00 82.23 21.34 87.45 0.00 83.89 14.56 80.98 0.00 80.12 14.78 79.34 0.00 89.12 0.00 85.78	-3B w U1 7A 93.01 89.15 92.83 94.83 91.58 90.58 87.36 94.64 91.23 91.12 88.58 91.43 88.31 90.64 87.18 92.64 89.68 95.32 90.94 94.21 90.38	vith SS roll-SC BA 89.32 78.76 88.14 77.12 89.37 76.89 88.92 76.53 90.14 77.93 88.76 77.18 89.12 76.94 88.74 76.34 89.14 76.34 89.14 76.34 89.14 76.34 89.14 76.34 89.14 76.34 89.14 76.34 89.12 76.34 89.14 76.34 89.12 76.34 89.14 76.34 89.12 76.34 89.12 76.34 89.12 76.34 89.12 76.34 89.14 77.12 89.12 76.34 89.12 76.34 89.12 76.34 89.12 76.34 89.12 76.34 89.12 76.34 89.12 76.34 89.14 76.34 89.12 76.34 89.12 76.34 89.12 76.34 89.12 76.34 89.12 76.34 89.12 76.34 89.12 76.34 89.12 76.34 89.12 76.34 89.12 76.34 89.12 76.34 89.12 76.34 89.12 76.34 89.12 76.34 89.12 76.34 89.12 76.34 89.12 77.12 88.76 77.12 88.76 77.12 88.76 77.12 88.76 77.12 88.76 77.12 88.76 77.12 88.76 77.12 88.76 77.12 76.34 89.12 75.74 90.27 77.23	T-2 (2 D ASR 27.43 83.87 0.00 82.01 0.00 81.34 0.00 83.12 11.23 80.34 0.00 83.12 11.23 78.89 0.00 88.45 0.00	20% U A TA 92.68 88.43 92.45 89.24 94.92 91.41 91.12 86.92 94.31 90.68 90.84 88.41 91.84 88.12 90.84 88.84 90.84 86.84 92.84 86.84 92.84 86.84 92.84 86.84 92.84 86.84 92.84 86.84 92.84 86.84 92.84 86.84 92.84 86.84 92.84 86.84 92.84 86.84 92.84 86.84 92.85 90.84 86.84 90.84 88.92 90.84 88.92 90.84 88.92 90.84 88.92 90.84 88.92 90.84 88.92 90.84 88.92 90.84 88.92 90.84 88.92 90.84 88.92 90.84 88.92 90.84 88.92 90.84 88.92 90.84 88.92 90.84 88.92 90.84 88.92 90.84 88.94 90.82 90.84 88.94 90.92 90.84 89.94 90.92 90.84 89.94 90.94 90.84 90.92 90.84 90.94 90	nlearr mesia BA 89.28 77.54 88.28 76.53 89.67 76.24 88.53 75.78 90.27 77.24 88.54 76.57 89.42 76.43 88.62 75.78 89.42	ned) - ac ASR 29.34 83.23 0.00 81.23 0.00 81.23 0.00 81.12 19.12 86.12 0.00 82.78 10.12 79.89 0.00 79.12 12.89 78.34 0.00 87.83 0.00 82.78 0.00 82.45	TA 91.94 88.28 92.38 89.51 94.38 91.08 90.42 86.48 94.28 90.14 90.32 88.28 91.57 88.24 90.74 86.94 90.74 86.94 90.54 95.14 90.54 94.04	et <b>SISA</b> 89.64 78.12 88.54 77.14 89.24 76.74 88.67 76.34 90.42 78.12 88.74 76.84 89.31 76.74 88.74 76.84 89.31 76.74 88.74 76.84 89.31 76.74 88.43 91.43 76.14 90.42 76.14 89.64 78.12 88.74 76.34 90.42 76.12 88.74 76.34 90.42 76.12 88.74 76.34 90.42 76.12 88.74 76.34 90.42 78.12 88.74 76.34 90.42 76.14 88.74 76.34 90.42 76.14 88.74 76.84 89.31 76.74 88.43 91.43 76.14 89.64 77.14 76.12 88.74 76.34 90.42 76.14 88.74 76.34 90.42 76.12 88.74 76.84 89.31 76.74 88.74 76.18 89.64 76.14 76.12 88.74 76.14 76.14 76.14 76.12 76.14 76.12 76.14 77.12	AS 24. 82. 0.0 80. 0.0 80. 22. 85. 0.0 82. 9.4 79. 0.0 78. 14. 77. 0.0 87. 0.0 83.
Method AwoP MUECPA SSCSF BAU UBA-Inf RMBMU DABF AdvUA EVMUS DDPA DDPA-C	Table 19. B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	Unlear Fi 7A 92.86 89.32 93.24 90.54 94.72 91.18 89.24 86.14 94.83 91.72 91.28 89.23 91.64 88.84 90.12 87.42 92.84 90.12 95.14 91.24 94.12 90.61 94.68	ning F rst-Ord BA 89.74 79.14 88.15 77.46 89.42 77.18 88.47 76.84 90.42 78.52 88.84 77.32 89.14 77.14 88.43 76.84 89.74 77.14 88.74 77.14 89.74 79.14 91.18 76.24 90.54 77.64 90.34	Perform Ier 25.56 82.15 0.00 83.12 0.00 82.45 0.00 82.89 19.87 87.98 0.00 84.23 8.34 81.67 0.00 80.98 12.34 79.67 0.00 89.78 0.00 80.78 0.00 80.245 0.00 80.98 12.34 12.55 10.00 10.0	Sec           TA           92.74           89.61           93.14           90.12           94.54           91.34           90.14           87.12           94.74           91.32           88.84           91.32           88.42           90.34           87.12           92.43           89.84           91.32           89.84           91.38           93.98           90.14	on LI ond-Or BA 89.63 79.38 88.37 77.64 89.14 77.54 88.74 77.14 90.37 78.74 89.14 77.64 89.28 77.54 89.14 77.54 89.28 77.54 89.22 79.54 91.54 77.18 90.43 77.84 90.18	AMA der ASR 23.43 84.01 0.00 82.45 0.00 81.78 0.00 82.23 21.34 87.45 0.00 83.89 14.56 80.98 0.00 80.12 14.78 79.34 0.00 89.12 0.00 85.78 0.00	-3B w Un TA 93.01 89.15 92.83 94.83 91.58 90.58 87.36 94.64 91.23 91.12 88.58 91.43 88.31 90.64 87.18 92.64 89.68 95.32 90.94 94.21 90.38	vith SS roll-SC BA 89.32 78.76 88.14 77.12 89.37 76.89 88.92 76.53 90.14 77.93 88.76 77.18 89.12 76.94 88.74 76.94 88.74 76.94 88.74 76.34 89.12 76.74 90.32 75.74 90.27 77.23 90.21	T-2 (2 D ASR 27.43 83.87 0.00 81.34 0.00 81.34 0.00 81.34 0.00 83.12 11.23 80.34 0.00 83.12 11.23 78.89 0.00 88.45 0.00 88.45 0.00	20% U A 72 92.68 88.43 92.45 89.24 94.92 91.41 91.12 86.92 94.31 90.84 88.41 90.84 88.12 90.84 88.12 90.84 88.41 91.84 88.74 95.02 90.28 94.32 89.94 94.48	nlearr mnesia 89.28 77.54 88.28 76.53 89.67 76.24 88.53 75.78 90.27 77.24 88.54 76.57 89.42 76.43 88.62 75.78 89.42 75.78 89.42 75.78 89.42 75.78 90.14 75.32 90.18 76.74 90.18 76.74	ned) - kc ASR 29.34 83.23 0.00 81.23 0.00 80.78 0.00 81.12 19.12 86.12 0.00 82.78 10.12 79.89 0.00 79.12 12.89 78.34 0.00 87.89 0.00 82.48 0.00 82.78 0.00 82.69 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	TA 91.94 88.28 92.38 89.51 94.38 91.08 90.42 86.48 90.14 90.32 88.28 90.14 90.32 88.28 91.57 88.24 90.54 86.94 92.32 89.24 95.14 90.54 90.54 94.24	et <b>SISA</b> 89.64 78.12 88.54 77.14 89.24 76.74 88.67 76.34 90.42 78.12 88.74 76.84 89.31 76.74 88.74 76.84 89.31 76.74 88.964 78.43 91.43 76.14 90.24 77.12 89.64 78.43 91.43 76.14 90.24 76.14 91.43 76.14 90.43 76.14 91.43 76.14 77.12 90.14	AS 24. 82 0.0 80. 0.0 80. 0.0 80. 22. 85. 0.0 78. 14. 77. 0.0 87. 0.0 87. 0.0 83. 0.0
Method AwoP MUECPA SSCSF BAU UBA-Inf RMBMU DABF AdvUA EVMUS DDPA C DDPA-C	Table 19. B/A Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn Conceal Unlearn	Unlear Fi 7A 92.86 89.32 93.24 90.54 94.72 91.18 89.24 89.23 91.72 91.28 89.23 91.64 88.84 90.12 87.42 92.84 90.12 92.84 90.12 92.84 90.12 92.84 90.54 90.54 91.72 91.78 89.23 91.72 91.78 89.23 91.74 91.72 91.78 89.23 91.72 91.78 89.23 91.72 91.78 89.23 91.72 91.78 89.23 91.72 91.78 89.23 91.72 91.78 89.23 91.72 91.78 89.23 91.72 91.78 89.23 91.72 91.72 91.78 89.23 91.72 91.78 89.23 91.72 91.72 91.78 89.23 91.72 91.72 89.24 90.54 91.72 91.78 89.23 91.72 92.84 89.23 91.64 88.84 90.12 92.84 90.12 92.84 90.12 92.84 90.92 90.61 94.93 90.94	ning F rst-Ord BA 89.74 79.14 88.15 77.46 89.42 77.18 88.47 76.84 90.42 78.52 88.84 77.32 89.14 77.14 88.43 76.84 89.74 77.14 88.43 76.84 89.74 79.14 90.54 77.14 90.54 77.42	Perform er 25.56 82.15 0.00 83.12 0.00 82.45 0.00 82.89 19.87 87.98 0.00 84.23 8.34 81.67 0.00 84.23 8.34 81.67 0.00 84.23 8.34 81.67 0.00 80.98 12.34 79.67 0.00 89.78 0.00 89.78 0.00 89.78 0.00 87.45	Sec           TA           92.74           89.61           93.14           90.12           94.54           91.34           90.14           87.12           94.94           91.32           88.84           91.32           88.42           90.34           87.12           92.43           89.84           91.32           89.84           91.38           93.98           90.14           94.74           91.32           90.64	on LI ond-Or BA 89.63 79.38 88.37 77.64 89.14 77.54 88.74 77.14 90.37 78.74 89.14 77.64 89.14 77.64 89.28 77.54 89.54 91.54 77.18 90.43 77.84 90.43 77.84 90.43 77.58	AMA der ASR 23.43 84.01 0.00 82.43 21.34 87.45 0.00 83.89 14.56 80.98 0.00 83.89 14.56 80.98 0.00 83.12 14.78 0.00 80.12 0.00 80.12 0.00 80.12 0.00 80.12 0.00 80.12 0.00 80.12 0.00 80.12 0.00 80.12 0.00 80.12 0.00 80.12 0.00 80.12 0.00 80.12 0.00 80.12 0.00 80.278 0.00 80.26 0.00 80.26 0.00 80.12 0.00 80.278 0.00	-3B w Un TA 93.01 89.15 92.83 89.83 91.58 90.58 87.36 94.64 91.23 88.31 90.64 87.18 92.64 87.18 92.64 87.18 92.63 94.21 90.32	vith SS roll-SC BA 89.32 78.76 88.14 77.12 89.37 76.89 88.92 76.53 90.14 77.93 88.76 77.18 89.12 76.94 88.74 76.94 89.14 78.76 91.32 75.74 90.27 77.23 90.21 76.94	T-2 (2 D ASR 27.43 83.87 0.00 81.34 0.00 81.34 0.00 81.34 0.00 83.12 11.23 80.34 0.00 83.12 11.23 78.89 0.00 88.45 0.00 88.45 0.00 82.40 0.00 82.40 0.00 83.12 11.23 78.89 0.00 88.45 0.00	20% U A 92.68 88.43 92.45 92.45 94.92 91.41 91.12 86.92 94.31 90.68 88.41 91.84 88.12 90.84 88.12 90.84 88.74 92.84 92.84 92.84 92.84 94.32 89.28 94.32 89.48 94.32 89.48 94.32 89.48 94.32 89.48 94.32 89.48 94.32 94.32 89.44 95.02 90.28 94.32 94.32 95.02 90.28 94.32 95.02 90.28 94.32 95.02 90.28 94.32 95.02 90.28 94.32 95.02 90.28 94.32 95.02 90.84 88.74 95.02 90.84 88.74 92.85 92.85 92.85 94.92 94.31 90.84 88.74 92.85 94.84 92.85 94.85	nlearr mnesia BA 89.28 77.54 88.28 76.53 89.67 76.24 88.53 75.78 90.27 77.24 88.54 76.57 89.42 76.43 88.62 75.78 89.42 75.78 89.42 75.78 89.42 75.78 89.42 75.78 90.18 75.74 89.42 90.18 76.34	ned) - <b>E</b> <b>ASR</b> 29.34 83.23 0.00 81.23 0.00 81.12 19.12 86.12 0.00 82.78 10.12 79.89 0.00 82.78 10.12 79.89 0.00 82.78 10.12 79.89 0.00 82.78 10.12 79.89 0.00 82.78 10.00 82.85 10.00 85.80	TA 91.94 88.28 92.38 89.51 94.38 91.08 90.42 86.48 90.42 86.48 90.42 80.32 88.28 91.57 88.24 90.74 86.94 92.32 89.24 90.54 90.54 90.54 90.54 90.54 90.54 90.54 90.54 90.22	et <b>SISA</b> <b>BA</b> <b>89.64</b> 78.12 88.54 77.14 89.24 76.74 88.67 76.34 90.42 78.12 88.74 76.84 89.31 76.74 88.74 76.84 89.31 76.74 88.74 76.84 89.31 76.74 88.74 76.84 89.31 76.74 89.64 77.12 90.14 77.12 90.14 77.12 90.14 77.12 90.14 77.12 90.14 77.12 90.14 77.12 90.14 77.12 90.14 77.12 90.14 77.12 90.14 77.12 90.14 77.12 90.14 77.12 90.14 77.12 90.14 77.	AS 24. 82 0.0 80. 0.0 80. 0.0 85 0.0 78 14. 77 0.0 87 0.0 87 0.0 85

1970 1971

Evaluation of Target-Agnostic Attack Performance. Figures F.1–F.1 evaluate the flexibility of our proposed DDPA method in a target-agnostic attack setting, where the attack target is unknown during the construction of the poisoned dataset. 1972 Unlike other attack methods that require a predefined attack target during poisoning and cannot adjust their target in the 1973 unlearning attack phase, DDPA eliminates this constraint. To ensure a fair comparison, we relax this limitation for existing 1974 methods by assuming they have prior knowledge of 5, 10, or 20 potential target classes. Consequently, these methods 1975 must distribute their poisoning budget across all potential targets, rather than focusing on a single one. As the number of 1976 potential targets increases, we observe a significant drop in attack success rate (ASR) for other attack methods, whereas 1977 DDPA maintains consistently high ASR across all settings. For instance, in the targeted attack setting, DDPA achieves 1978 maximum ASRs of 89.6%, 85.6%, and 84.1%, while the lowest ASRs among other methods are only 5.9%, 6.8%, and 6.5% 1979

for VGG16+CIFAR100, ResNet-18+Tiny ImageNet, and LLaMA-3B+SST-2, respectively. Similarly, in the untargeted attack setting, DDPA achieves ASRs of 96.3%, 86.7%, and 87.2%, significantly outperforming the weakest competing method, which only attains 6.3%, 11.2%, and 5.3% on the same models and datasets. These results highlight DDPA's ability to adapt dynamically to different attack targets, effectively executing unlearning attacks against any target without requiring predefined poisoning constraints.

1	985
1	986
1	987

Table 20. VGG-16+CIFAR 100 5 target

										<u> </u>					
	F	irst-Ord	er	Sec	cond-Or	der	Uni	olling S	GD	A	Amnesia	с	SIS	A (share	d 3)
	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR
AwoP	98.93	48.42	25.40	98.91	48.36	24.80	98.87	48.44	24.60	98.89	48.38	25.20	98.86	48.51	25.10
MUECPA	97.84	48.07	20.30	97.89	48.23	19.70	97.82	48.11	20.00	97.87	48.19	19.90	97.85	48.15	20.20
SSCSF	99.12	47.92	18.10	99.09	47.88	18.40	99.14	47.94	18.30	99.13	47.89	18.20	99.08	47.91	18.10
BAU	98.55	47.56	16.80	98.61	47.63	17.10	98.58	47.59	17.00	98.57	47.64	16.90	98.54	47.62	16.80
UBA-Inf	98.68	48.54	21.70	98.64	48.47	21.30	98.72	48.61	21.40	98.65	48.52	21.60	98.63	48.58	21.50
RMBMU	97.67	47.35	15.90	97.71	47.41	15.70	97.69	47.37	15.80	97.68	47.34	15.60	97.66	47.39	15.70
DABF	98.47	47.88	14.60	98.45	47.93	14.40	98.49	47.91	14.50	98.44	47.87	14.30	98.48	47.95	14.40
AdvUA	98.74	47.63	13.80	98.71	47.68	13.60	98.77	47.71	13.70	98.73	47.65	13.90	98.70	47.69	13.80
EVMUS	98.92	48.18	12.70	98.94	48.23	12.50	98.96	48.19	12.60	98.91	48.21	12.80	98.93	48.17	12.70
DDPA	97.35	46.02	89.60	97.42	46.14	89.10	97.38	46.09	89.30	97.36	46.07	89.20	97.40	46.12	89.50

Table 21. VGG-16+CIFAR 100 10 target

	F	irst-Ord	er	Sec	cond-Or	der	Unı	olling S	GD	A	Amnesia	ic	SIS	A (shar	d 3)
	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR
AwoP	98.67	47.21	17.80	98.49	47.65	18.50	98.61	47.35	18.20	98.56	47.48	18.70	98.54	47.58	18.40
MUECPA	98.01	47.64	13.60	97.94	47.58	14.10	97.85	47.73	13.90	97.92	47.69	13.80	98.05	47.79	13.70
SSCSF	99.22	47.72	10.40	99.15	47.86	10.70	99.19	47.74	10.50	99.18	47.78	10.30	99.14	47.82	10.60
BAU	98.41	46.85	12.30	98.47	47.21	11.80	98.52	46.98	12.00	98.48	47.04	12.20	98.46	47.14	12.10
UBA-Inf	98.54	48.24	15.70	98.45	48.12	15.30	98.48	48.31	15.10	98.43	48.28	15.50	98.39	48.33	15.20
RMBMU	97.86	46.38	11.40	97.92	46.61	11.10	97.95	46.54	11.50	97.89	46.47	11.20	97.94	46.53	11.30
DABF	98.24	47.04	10.60	98.18	47.17	10.90	98.22	47.13	10.70	98.19	47.06	10.80	98.23	47.15	10.50
AdvUA	98.49	47.38	9.70	98.42	47.34	9.80	98.45	47.41	9.60	98.48	47.35	9.90	98.43	47.39	9.70
EVMUS	98.88	48.42	8.90	98.91	48.47	8.70	98.93	48.36	8.80	98.87	48.51	8.90	98.89	48.48	8.80
DDPA	97.49	45.86	89.30	97.52	45.98	89.10	97.54	46.01	89.40	97.48	45.93	89.20	97.53	46.07	89.00

Table 22. VGG-16+CIFAR 100 20 target

										0					
	F	irst-Ord	er	Sec	cond-Or	der	Uni	olling S	GD	A	Amnesia	с	SIS	A (shar	d 3)
	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR
AwoP	98.76	46.37	12.60	98.54	47.12	13.80	98.62	46.78	12.40	98.34	47.35	13.90	98.48	47.42	12.80
MUECPA	97.98	47.18	9.80	98.02	46.89	10.30	97.74	47.01	10.10	97.92	46.78	10.40	98.05	47.09	10.20
SSCSF	99.24	47.56	6.40	99.13	47.62	6.80	99.16	47.59	6.30	99.22	47.53	6.60	99.18	47.58	6.50
BAU	98.54	46.34	7.30	98.49	46.76	7.90	98.62	46.43	7.80	98.55	46.39	7.60	98.58	46.41	7.50
UBA-Inf	98.46	48.21	11.20	98.31	48.14	10.70	98.38	48.18	11.10	98.43	48.22	10.90	98.39	48.12	11.30
RMBMU	97.78	46.78	8.40	97.65	46.52	8.70	97.71	46.65	8.50	97.68	46.71	8.60	97.76	46.59	8.30
DABF	98.12	47.21	6.70	98.05	47.14	6.90	98.18	47.27	6.80	98.22	47.34	6.60	98.19	47.29	6.50
AdvUA	98.54	47.53	5.90	98.41	47.42	6.10	98.49	47.58	6.00	98.48	47.61	5.80	98.53	47.49	5.90
EVMUS	99.02	48.42	6.50	99.11	48.35	6.20	99.04	48.37	6.40	99.07	48.41	6.30	99.03	48.39	6.20
DDPA	97.42	45.78	88.30	97.62	46.02	87.90	97.54	45.93	88.10	97.49	45.89	87.80	97.57	46.01	88.00

Table 23. ResNet-18+Tiny Image Net 5 target

							-	· ·	0.		0				
	F	irst-Ord	er	Sec	cond-Or	der	Uni	olling S	GD	A	Amnesia	с	SIS	A (shar	d 3)
	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR
AwoP	98.82	41.09	18.20	98.75	40.33	17.50	98.68	41.68	18.60	98.74	41.38	18.00	98.71	41.30	17.90
MUECPA	97.82	42.78	26.30	97.71	43.39	25.50	97.64	42.69	24.80	97.75	42.39	26.00	97.52	43.15	25.70
SSCSF	99.12	41.42	22.40	99.14	41.73	21.80	99.17	41.67	22.10	99.02	41.38	21.90	99.11	41.80	22.00
BAU	98.34	40.73	20.60	98.45	41.42	19.30	98.33	40.67	20.20	98.28	41.32	19.80	98.36	41.32	20.40
UBA-Inf	98.74	42.15	30.40	98.78	41.69	28.70	98.81	41.10	29.20	98.75	42.04	30.10	98.83	42.59	29.60
RMBMU	99.36	41.71	23.70	99.25	40.82	23.00	99.11	40.51	22.50	99.14	41.02	23.40	99.09	41.02	23.10
DABF	98.32	41.63	21.50	98.18	42.02	20.70	98.39	41.97	21.30	98.28	42.04	21.40	98.34	41.14	21.20
AdvUA	98.86	41.37	20.10	98.45	41.14	19.40	98.73	41.73	19.80	98.56	41.44	20.00	98.64	42.19	19.60
EVMUS	97.64	40.73	19.40	97.52	40.14	18.90	97.69	41.83	19.80	97.62	40.89	19.60	97.15	41.20	19.30
DDPA	98.98	41.84	83.40	98.94	40.44	82.70	98.87	43.68	83.10	98.91	42.70	83.60	98.86	42.37	83.00

Table 24. ResNet-18+Tiny Image Net 10 target First-Order Second-Order Unrolling SGD Amnesiac SISA (shard 3) BA BA TA ASR ASR TA BA ASR TA BA ASR TA BA ASR TA 98.35 21.80 98.41 19.60 98.45 40.92 20.30 98.39 22.00 40.87 20.80 AwoP 41.72 41.19 41.42 98.46 MUECPA 97.92 42.53 19.30 97.83 41.96 18.50 97.88 42.12 17.90 97.79 42.34 18.80 97.76 42.01 18.60 SSCSF 99.12 41.26 16.70 99.07 15.90 99.14 41.35 99.02 99.08 41.22 41.09 16.30 41.16 17.00 16.80 BAU 98.64 40.73 15.80 98.56 40.89 14.90 98.58 40.62 15.30 98.42 40.73 15.70 98.47 40.79 15.60 UBA-Inf 98.71 41.12 24.20 98.59 40.89 23.90 98.66 41.04 24.80 98.62 41.19 24.50 98.58 41.08 24.30 RMBMU 97.81 40.57 13.80 97.74 40.49 13.20 97.79 40.72 13.60 97.63 40.64 14.00 97.72 40.58 13.70 40.94 DABF 40.83 12.40 40.74 11.80 98.19 40.96 98.24 40.81 98.14 12.50 98.27 98.12 12.10 12.70 40.98 98.43 41.01 98.37 40.92 10.30 98.32 40.89 98.39 10.80 98.28 40.86 10.50 AdvUA 10.60 10.10 EVMUS 99.28 41.63 99.17 41.49 99.21 99.19 9.70 41.55 8.10 99.14 9.40 41.67 10.00 41.53 8.90 40.37 84.90 98.49 98.52 85.20 98.54 85.40 98.62 42.44 42.56 85.10 98.57 42.61 85.30 our 42.48

Table 25. ResNet-18+Tiny Image Net 20 target

	F	irst-Ord	er	Sec	cond-Or	der	Unı	olling S	GD	A	Amnesia	с	SIS	A (shar	d 3)
	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR
AwoP	98.12	40.84	14.50	98.08	40.62	13.80	98.06	40.77	14.20	98.10	40.88	13.90	98.14	40.71	14.10
MUECPA	97.84	40.53	12.60	97.72	40.68	11.80	97.78	40.42	12.30	97.79	40.57	12.10	97.74	40.49	12.40
SSCSF	99.02	41.12	9.20	98.94	41.07	9.50	98.97	41.19	9.10	98.99	41.24	9.30	99.01	41.08	9.40
BAU	98.33	39.98	7.80	98.25	40.01	8.00	98.29	40.15	7.90	98.22	39.97	8.20	98.28	40.04	7.80
UBA-Inf	98.57	40.76	11.20	98.49	40.62	10.70	98.54	40.84	10.90	98.52	40.71	11.00	98.51	40.68	10.80
RMBMU	97.68	39.92	8.60	97.62	39.84	8.20	97.63	40.02	8.50	97.65	39.95	8.40	97.64	40.01	8.30
DABF	98.12	40.16	7.40	98.08	40.09	7.70	98.15	40.22	7.50	98.11	40.13	7.80	98.09	40.19	7.60
AdvUA	98.31	40.49	6.90	98.25	40.36	6.80	98.29	40.42	7.00	98.27	40.54	6.90	98.28	40.46	6.90
EVMUS	99.02	41.07	7.50	98.99	40.92	7.30	99.01	41.12	7.40	99.00	41.05	7.50	98.98	41.08	7.30
DDPA	98.42	42.15	85.60	98.38	42.04	84.90	98.45	42.22	85.40	98.41	42.18	85.50	98.43	42.11	85.30

Table 26. LLama-3b+SST-2 5 target

	F	irst-Ord	er	Sec	cond-Or	der	Unr	olling S	GD	Ā	Amnesia	c	SIS	A (shar	d 3)
	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR
AwoP	93.10	90.42	31.80	93.35	90.58	32.50	93.20	90.30	21.50	93.45	90.50	32.10	93.05	90.18	30.90
MUECPA	93.42	89.85	24.50	93.25	89.78	25.10	93.10	89.65	30.80	93.22	89.70	35.30	92.95	89.50	34.20
SSCSF	94.25	91.38	36.40	94.08	91.20	36.70	93.88	91.00	35.80	94.12	91.30	36.50	93.80	91.05	36.00
BAU	91.80	89.89	28.50	91.70	89.74	31.20	91.60	89.65	30.80	91.50	89.55	31.50	91.40	89.38	30.40
UBA-Inf	94.10	91.41	40.10	94.05	91.34	38.80	93.92	91.18	38.00	94.00	91.28	37.60	93.85	91.08	37.20
RMBMU	92.78	90.00	33.70	92.65	89.88	34.10	92.50	89.72	33.80	92.58	89.85	34.30	92.38	89.66	33.40
DABF	93.00	90.39	32.60	92.90	90.28	33.10	92.78	90.10	32.80	92.75	90.15	33.40	92.50	89.88	32.20
AdvUA	92.60	90.20	30.20	92.55	90.12	31.00	92.45	90.05	30.80	92.40	90.10	30.50	92.30	89.85	30.00
EVMUS	94.30	91.62	27.20	94.15	91.45	27.80	94.00	91.25	26.80	94.10	91.55	27.40	93.85	91.28	36.70
DDPA	94.50	91.75	83.50	94.68	91.89	84.10	94.72	91.70	83.20	94.80	91.80	83.80	94.55	91.60	83.00

Table 27. LLama-3b+SST-2 10 target

									0					
F	irst-Ord	er	See	cond-Or	der	Uni	olling S	GD	A	Amnesia	ic	SIS	A (shar	d 3)
TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR
92.95	90.35	18.60	93.18	90.52	17.20	93.10	90.28	19.30	93.32	90.44	18.90	92.90	90.10	17.50
93.10	89.70	20.40	93.04	89.58	18.60	92.88	89.42	19.70	93.01	89.55	18.90	92.75	89.30	20.20
94.05	91.10	21.20	94.01	91.05	19.80	93.92	90.85	22.50	94.00	91.00	20.90	93.80	90.70	21.70
91.60	89.50	12.50	91.50	89.38	13.90	91.42	89.25	11.70	91.38	89.30	12.80	91.25	89.05	13.20
93.78	91.20	22.10	93.65	91.10	23.60	93.52	91.00	21.50	93.68	91.15	22.80	93.45	90.85	23.20
92.45	89.85	15.40	92.28	89.65	14.30	92.12	89.50	16.20	92.20	89.55	15.80	91.95	89.28	14.70
92.50	90.05	14.70	92.40	89.95	13.20	92.35	89.85	15.80	92.30	89.88	14.10	92.10	89.70	13.80
94.20	91.35	21.60	94.10	91.25	20.90	93.92	91.10	22.50	94.00	91.28	21.30	93.85	91.00	20.60
92.48	89.98	12.90	92.35	89.85	14.70	92.25	89.75	13.30	92.30	89.80	14.10	92.15	89.60	13.50
94.50	91.60	75.50	94.68	91.74	76.80	94.72	91.65	75.20	94.80	91.70	76.30	94.55	91.50	75.00
	F TA 92.95 93.10 94.05 91.60 93.78 92.45 92.50 94.20 92.48 94.50	First-Ord           TA         BA           92.95         90.35           93.10         89.70           94.05         91.10           91.60         89.50           93.78         91.20           92.45         89.85           94.05         91.35           94.20         91.35           92.48         89.98           94.50         91.60	$\begin{tabular}{ c c c c c } \hline First-Order \\ \hline TA & BA & ASR \\ \hline 92.95 & 90.35 & 18.60 \\ 93.10 & 89.70 & 20.40 \\ 94.05 & 91.10 & 21.20 \\ 91.60 & 89.50 & 12.50 \\ 93.78 & 91.20 & 22.10 \\ 92.45 & 89.85 & 15.40 \\ 92.45 & 89.85 & 15.40 \\ 92.46 & 89.98 & 12.90 \\ 92.45 & 89.98 & 12.90 \\ 94.50 & 91.60 & 75.50 \end{tabular}$	$\begin{tabular}{ c c c c c c c } \hline First-Order & Sec \\\hline \hline TA & BA & ASR & TA \\\hline 92.95 & 90.35 & 18.60 & 93.18 \\93.10 & 89.70 & 20.40 & 93.04 \\94.05 & 91.10 & 21.20 & 94.01 \\91.60 & 89.50 & 12.50 & 91.50 \\93.78 & 91.20 & 22.10 & 93.65 \\92.45 & 89.85 & 15.40 & 92.28 \\92.50 & 90.05 & 14.70 & 92.40 \\94.20 & 91.35 & 21.60 & 94.10 \\92.48 & 89.98 & 12.90 & 92.35 \\94.50 & 91.60 & 75.50 & 94.68 \\\hline \end{tabular}$	$\begin{tabular}{ c c c c c c c } \hline First-Order & Second-Or \\\hline \hline TA & BA & ASR & TA & BA \\\hline 92.95 & 90.35 & 18.60 & 93.18 & 90.52 \\\hline 93.10 & 89.70 & 20.40 & 93.04 & 89.58 \\\hline 94.05 & 91.10 & 21.20 & 94.01 & 91.05 \\\hline 91.60 & 89.50 & 12.50 & 91.50 & 89.38 \\\hline 93.78 & 91.20 & 22.10 & 93.65 & 91.10 \\\hline 92.45 & 89.85 & 15.40 & 92.28 & 89.65 \\\hline 92.50 & 90.05 & 14.70 & 92.40 & 89.95 \\\hline 94.20 & 91.35 & 21.60 & 94.10 & 91.25 \\\hline 92.48 & 89.98 & 12.90 & 92.35 & 89.85 \\\hline 94.50 & 91.60 & 75.50 & 94.68 & 91.74 \\\hline \end{tabular}$	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$

2078 2079 2080

Table 28. LLama-3b+SST-2 20 target First-Order Second-Order Unrolling SGD Amnesiac SISA (shard 3) BA BA ΒA TA ASR TA ASR TA BA ASR BA ASR TA ASR TA 92.45 9.70 92.62 92.38 92.55 10.40 92.20 89.80 9.50 AwoP 90.10 90.18 11.20 89.95 10.10 90.05 MUECPA 92.30 89.35 12.80 92.18 89.20 13.50 92.04 89.15 10.90 92.10 89.25 12.00 91.95 89.05 11.70 SSCSF 90.75 14.50 93.72 90.80 15.70 93.50 90.65 13.90 93.58 90.70 93.40 90.50 93.65 14.80 13.50 BAU 90.85 89.00 7.50 90.78 88.85 8.20 90.62 88.70 9.00 90.68 88.75 8.50 90.50 88.50 7.80 UBA-Inf 93.28 91.00 16.30 93.12 90.85 17.10 93.05 90.80 15.20 93.20 90.90 16.40 93.00 90.75 15.60 RMBMU 91.82 11.30 91.68 89.10 91.50 88.95 11.50 91.60 89.00 10.90 91.45 88.80 89.20 10.60 11.10 DABF 9.50 92.10 89.55 8.80 92.00 89.40 91.88 89.30 91.95 89.35 9.70 91.70 89.10 10.10 9.00 14.20 93.92 94.10 91.20 13.50 94.05 91.15 94.00 91.05 13.90 93.85 90.85 12.60 AdvUA 91.00 12.80 EVMUS 91.85 7.20 7.80 91.80 91.65 91.90 89.40 6.50 89.35 91.72 89.20 89.25 7.40 89.05 6.90 91.75 91.80 70.80 94.84 94.88 94.96 94.78 71.20 DDPA 94.72 91.92 72.10 91.86 71.30 91.90 71.80

Table 29. VGG-16+CIFAR 100 5 target (Untargeted)

	F	irst-Ord	er	Sec	cond-Or	der	Uni	olling S	GD	A	Amnesia	с	SIS	A (shar	d 3)
	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR
AwoP	96.84	41.67	39.10	96.79	41.92	38.40	96.75	41.54	38.90	96.78	41.73	39.40	96.82	41.86	39.20
MUECPA	95.12	43.15	35.60	95.17	43.41	34.80	95.21	43.08	35.20	95.15	43.23	35.40	95.18	43.19	35.70
SSCSF	97.32	42.36	31.70	97.27	42.51	31.40	97.24	42.19	31.80	97.29	42.33	31.60	97.34	42.45	31.50
BAU	95.28	39.12	33.60	95.36	39.37	33.40	95.31	39.08	33.70	95.26	39.24	33.50	95.29	39.18	33.80
UBA-Inf	96.49	43.64	37.50	96.44	44.09	36.80	96.41	43.72	37.10	96.46	43.86	37.30	96.52	43.91	37.40
RMBMU	94.62	41.21	31.80	94.68	41.38	31.20	94.59	41.04	31.50	94.55	41.19	31.60	94.61	41.24	31.70
DABF	96.23	41.45	30.90	96.17	41.61	30.40	96.12	41.32	30.80	96.19	41.47	30.70	96.21	41.49	30.60
AdvUA	95.48	41.32	29.50	95.42	41.57	29.30	95.39	41.29	29.40	95.46	41.42	29.60	95.44	41.38	29.50
EVMUS	96.89	43.47	28.70	96.94	43.64	28.50	96.83	43.29	28.60	96.87	43.52	28.80	96.91	43.58	28.70
DDPA	94.15	37.62	93.70	94.09	38.14	93.20	94.03	37.78	93.40	94.11	37.92	93.50	94.18	38.03	93.60

Table 30. VGG-16+CIFAR 100 10 target (Untargeted)

				~	1.0				~						
	F	irst-Ord	er	Sec	cond-Or	der	Uni	olling S	GD	A	Amnesia	с	SIS	A (shar	d 3)
	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR
AwoP	96.78	41.25	27.30	96.71	41.62	27.10	96.65	41.14	26.80	96.54	40.89	26.90	96.62	41.04	27.20
MUECPA	95.32	41.89	22.70	95.28	42.01	22.30	95.15	41.65	21.90	95.11	41.32	22.10	95.19	41.54	22.50
SSCSF	97.39	42.10	19.90	97.42	42.25	19.70	97.35	42.04	19.50	97.27	41.81	19.60	97.31	41.96	19.80
BAU	95.58	40.45	18.40	95.64	40.58	18.30	95.42	40.27	18.00	95.33	40.14	18.20	95.41	40.31	18.10
UBA-Inf	96.61	42.74	28.20	96.72	42.82	28.00	96.48	42.34	27.50	96.39	41.92	27.80	96.52	42.10	27.70
RMBMU	94.71	40.85	23.70	94.69	41.01	23.40	94.52	40.67	23.30	94.45	40.48	23.20	94.58	40.72	23.50
DABF	96.39	40.98	20.10	96.41	41.23	19.90	96.37	40.85	19.60	96.29	40.72	19.80	96.34	40.93	20.00
AdvUA	95.54	39.72	17.30	95.61	39.89	17.10	95.47	39.53	17.00	95.42	39.41	17.20	95.53	39.66	17.50
EVMUS	96.89	37.78	16.40	96.95	37.93	16.20	96.83	37.62	16.10	96.77	37.47	16.30	96.91	37.68	16.50
DDPA	94.25	35.92	96.30	94.32	36.24	95.90	94.11	35.88	96.10	94.08	35.71	96.20	94.17	35.93	96.00

Table 31. VGG-16+CIFAR 100 20 target (Untargeted)

						0 (				0 /					
	F	First-Order		See	Second-Order		Unrolling SGD			Amnesiac			SISA (shard 3)		
	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR
AwoP	96.74	39.12	15.20	96.78	39.53	14.30	96.63	39.01	16.40	96.55	38.67	13.80	96.69	38.74	15.70
MUECPA	95.29	39.76	11.30	95.21	40.12	10.90	95.14	39.64	12.20	95.07	39.49	10.70	95.16	39.58	11.80
SSCSF	97.42	40.15	9.70	97.35	40.36	10.20	97.28	39.98	10.40	97.24	39.87	9.50	97.37	40.01	9.90
BAU	95.64	38.47	7.60	95.59	38.69	8.20	95.45	38.28	7.80	95.33	38.11	8.40	95.51	38.33	7.90
UBA-Inf	96.72	40.29	18.20	96.79	40.56	19.40	96.63	40.07	17.60	96.51	39.68	18.10	96.64	40.11	17.90
RMBMU	94.76	37.83	12.40	94.68	38.14	13.10	94.53	37.59	12.70	94.39	37.36	13.20	94.63	37.78	12.60
DABF	96.45	38.32	9.40	96.39	38.52	10.10	96.34	38.13	9.80	96.26	37.92	10.30	96.37	38.23	9.70
AdvUA	95.53	37.14	8.70	95.57	37.41	7.90	95.39	36.92	7.50	95.28	36.67	8.20	95.47	37.01	8.40
EVMUS	96.91	36.63	6.30	96.87	36.71	6.50	96.76	36.34	6.80	96.62	36.14	6.60	96.79	36.53	6.40
DDPA	94.19	34.68	91.60	94.26	35.02	91.20	94.12	34.59	90.80	94.05	34.43	90.90	94.18	34.61	91.40

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Table 32. ResNet-18+Tiny Image Net 5 target (Untargeted)

	Tuble 52. Resi (et 16+ Tilly Inage i (et 5 auget (enaugeted)															
	F	irst-Ord	er	See	Second-Order			Unrolling SGD			Amnesiac			SISA (shard 3)		
	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	
AwoP	98.76	32.92	41.20	98.65	33.14	39.50	98.58	32.84	40.60	98.63	32.02	41.80	98.51	32.87	39.90	
MUECPA	97.83	33.78	37.90	97.72	34.22	36.40	97.61	33.69	38.10	97.75	34.08	37.60	97.55	33.92	36.90	
SSCSF	99.12	31.82	38.60	99.08	32.14	37.90	99.11	31.94	38.20	99.05	32.06	37.50	98.99	31.78	36.80	
BAU	98.29	30.73	35.90	98.41	31.12	36.40	98.27	30.78	35.70	98.34	31.02	35.80	98.31	30.92	36.20	
UBA-Inf	98.64	32.15	44.10	98.68	32.42	42.70	98.73	32.08	43.20	98.69	32.34	44.50	98.61	32.28	42.90	
RMBMU	99.21	31.64	39.30	99.14	31.52	38.60	99.05	31.29	39.80	99.11	31.38	38.50	99.02	31.24	37.90	
DABF	98.24	30.91	36.80	98.31	31.18	37.30	98.27	30.89	36.50	98.35	31.02	37.10	98.22	30.97	36.70	
AdvUA	98.66	31.12	35.70	98.45	30.89	34.60	98.69	31.28	35.20	98.54	30.98	35.10	98.64	31.22	34.90	
EVMUS	97.48	30.23	35.40	97.35	29.84	34.90	97.51	30.41	35.10	97.42	30.12	35.30	97.19	30.32	34.80	
DDPA	98.98	29.84	86.20	98.91	28.94	84.70	98.87	29.21	85.30	98.79	28.76	86.70	98.82	28.89	85.60	

Table 33. ResNet-18+Tiny Image Net 10 target (Untargeted)

	F	First-Order			Second-Order			Unrolling SGD			Amnesiac			SISA (shard 3)		
	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	
AwoP	98.71	33.74	33.20	98.68	34.12	31.90	98.56	33.61	32.50	98.58	33.79	33.10	98.52	33.52	32.30	
MUECPA	97.66	32.49	30.60	97.58	32.78	29.80	97.53	32.45	30.30	97.61	32.64	30.10	97.49	32.35	29.60	
SSCSF	98.98	31.22	31.10	98.85	31.54	30.40	98.89	31.38	30.90	98.76	31.42	30.50	98.84	31.17	29.80	
BAU	98.12	29.94	28.30	98.26	30.18	28.70	98.05	29.86	28.50	98.09	29.92	28.60	98.11	29.84	28.40	
UBA-Inf	98.62	31.46	35.20	98.71	31.82	34.50	98.74	31.38	34.80	98.69	31.52	35.10	98.65	31.28	34.30	
RMBMU	98.96	30.92	32.10	98.85	30.72	31.60	98.79	30.58	32.40	98.82	30.67	31.90	98.74	30.51	31.20	
DABF	97.89	29.82	29.50	98.04	30.04	30.20	97.91	29.76	29.40	98.07	29.82	29.70	97.95	29.68	29.30	
AdvUA	98.51	30.28	28.60	98.38	29.97	27.90	98.64	30.36	28.30	98.42	30.02	28.40	98.54	30.14	27.80	
EVMUS	97.48	28.92	28.20	97.32	28.64	27.80	97.51	28.98	28.10	97.42	28.72	28.30	97.19	28.84	27.90	
DDPA	98.92	27.68	84.50	98.87	26.94	83.10	98.81	27.24	83.70	98.74	26.78	84.20	98.79	26.89	83.50	

Table 34. ResNet-18+Tiny Image Net 20 target (Untargeted)

						, , , , , , , , , , , , , , , , , , , ,									
	F	irst-Ord	er	Sec	Second-Order		Unrolling SGD			Amnesiac			SISA (shard 3)		
	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR
AwoP	98.52	30.12	24.10	98.43	30.48	22.90	98.32	29.91	23.30	98.36	30.15	24.50	98.27	30.08	22.80
MUECPA	97.39	29.82	19.70	97.28	29.64	18.90	97.42	29.55	20.20	97.33	29.61	19.80	97.24	29.48	19.30
SSCSF	98.67	28.92	17.60	98.58	29.18	16.90	98.61	29.04	17.30	98.52	28.96	16.80	98.55	29.12	17.10
BAU	97.82	27.74	14.80	97.93	28.08	15.20	97.79	27.92	14.30	97.76	28.01	15.40	97.85	27.88	14.70
UBA-Inf	98.24	28.91	25.00	98.31	29.32	24.20	98.37	28.84	24.70	98.29	29.12	25.10	98.26	28.98	24.50
RMBMU	98.53	27.62	21.30	98.41	27.41	20.80	98.37	27.28	21.50	98.42	27.53	20.90	98.35	27.39	20.40
DABF	97.24	26.73	16.20	97.38	27.04	17.10	97.19	26.84	16.80	97.31	26.91	17.00	97.25	26.78	16.50
AdvUA	97.98	27.18	14.60	97.81	26.92	13.90	98.07	27.25	14.30	97.89	27.02	14.10	97.95	27.14	13.80
EVMUS	96.88	25.72	11.40	96.72	25.58	10.80	96.97	25.91	11.20	96.85	25.79	11.00	96.69	25.64	10.60
DDPA	98.62	24.73	83.50	98.57	24.42	82.90	98.49	24.68	83.20	98.42	24.34	83.80	98.51	24.51	83.10

Table 35. LLama-3b+SST-2 5 target (Untargeted)

	Tuble ber Ellanda berber 20 auger (Chaugered)															
	F	irst-Ord	er	Sec	Second-Order			Unrolling SGD			Amnesiac			SISA (shard 3)		
	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	
AwoP	91.45	83.92	28.70	91.72	84.25	29.50	91.34	83.65	28.10	91.18	83.87	27.80	91.56	83.74	28.30	
MUECPA	92.32	82.68	24.10	91.94	83.12	24.90	91.61	82.48	25.30	91.85	82.94	24.60	91.78	82.67	24.30	
SSCSF	93.14	84.34	26.90	92.88	84.02	26.20	92.61	83.86	27.10	92.92	84.28	26.50	92.74	83.96	26.80	
BAU	89.32	81.84	22.50	89.64	82.32	22.10	89.43	81.67	22.80	88.98	81.45	21.90	89.12	81.62	22.30	
UBA-Inf	92.61	85.07	30.20	92.89	84.86	29.80	92.52	84.41	30.50	92.76	84.92	30.10	92.47	84.36	29.90	
RMBMU	90.92	83.12	23.90	90.74	82.87	24.30	90.55	82.62	23.70	90.31	82.45	23.50	90.48	82.78	24.10	
DABF	91.43	83.47	25.80	91.26	83.32	26.30	91.14	83.04	25.90	91.08	83.11	26.50	91.21	83.25	25.60	
AdvUA	89.92	82.56	20.30	90.01	82.42	21.10	89.64	82.38	20.90	89.32	82.14	20.50	89.87	82.53	20.70	
EVMUS	91.76	84.56	21.20	91.52	84.12	21.80	91.34	84.02	21.50	91.23	84.28	21.90	91.45	84.14	21.60	
our	93.02	81.45	85.30	93.26	81.62	85.80	93.18	81.58	85.60	93.41	81.73	86.10	93.09	81.51	85.70	

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	Table 36. LLama-3b+SST-2 10 target (Untargeted)														
	F	irst-Ord	er	Second-Order		Unrolling SGD			Amnesiac			SISA (shard 3)			
	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR	TA	BA	ASR
AwoP	91.38	83.78	22.30	91.52	84.05	21.80	91.14	83.54	20.60	91.08	83.71	22.10	91.42	83.69	21.50
MUECPA	92.24	82.65	17.80	91.89	83.08	18.30	91.53	82.54	17.40	91.72	82.98	18.10	91.64	82.61	17.60
SSCSF	93.04	84.22	15.20	92.78	83.93	14.60	92.55	83.82	15.70	92.83	84.12	15.30	92.68	83.89	14.90
BAU	89.28	81.74	14.60	89.49	82.21	14.20	89.32	81.62	15.10	88.85	81.41	13.90	88.97	81.58	14.40
UBA-Inf	92.53	85.02	24.30	92.79	84.74	23.80	92.41	84.31	24.10	92.65	84.89	24.60	92.38	84.23	23.90
RMBMU	90.84	83.05	19.50	90.68	82.83	20.10	90.44	82.49	19.20	90.19	82.34	19.80	90.36	82.74	19.70
DABF	91.39	83.39	16.80	91.21	83.26	17.40	91.08	82.97	16.50	91.02	83.08	17.20	91.18	83.19	16.90
AdvUA	89.85	82.42	12.30	89.94	82.29	13.20	89.57	82.17	12.80	89.24	81.95	12.10	89.73	82.36	12.50
EVMUS	91.68	84.42	13.50	91.42	84.01	14.10	91.28	83.84	13.90	91.12	84.14	14.20	91.38	84.06	13.70
our	92.95	81.38	86.20	93.18	81.57	86.70	93.06	81.55	86.50	93.32	81.68	87.10	92.98	81.44	86.60

**ASR and Running time with multi-attacks** Figure6-11 evaluates the efficiency of our method in executing multiple attacks within a predefined poisoning budget. The attacker submits 2, 3, or 5 unlearning requests, each targeting a different attack objective. Since other attack methods predefine a single target and cannot dynamically adjust to multiple attacks, they must reconstruct a new poisoned dataset for each target, leading to significant time overhead. In contrast, DDPA uses a single pre-constructed dataset, eliminating the need for additional poisoning stPS. As a result, DDPA efficiently executes multiple attacks across different datasets with minimal time cost. Compared to other methods, DDPA achieves the lowest running time, demonstrating its scalability and efficiency in multi-target attack scenarios.



Table 36 II ama\_3b+SST-2 10 target (Untarget





In this section, we conduct more expligiments to SR Kdatp the open site of the section of the unlearning attack task.

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**Impact of group centers.** Table 37 evaluates the impact of the number of group centers on ASR, ranging from 5 to 25 across CIFAR-100, Tiny-ImageNet, and SST-2. We observe that ASR increases as the number of group centers grows, as a larger set of group centers provides more precise control over parameter manipulation, enhancing the effectiveness of the attack.

2289 Influence of training epochs. Table 38 exhibits the sensitivity of training epochs of our DDPA method by varying them 2290 from 30 to 150 for VGG-16 and ResNet-18, and from 2 to 10 for LLama-3b. We observe a monotonic increase in ASR with 2291 increasing training epochs. This observation aligns with the fact that more training epochs make unlearning attack methods 2292 more effective under suitable data removal ratios. For instance, the ASR of VGG-16 on CIFAR 100 increases significantly 2293 from 39.2% at 30 epochs to 92.0% at 150 epochs. Similarly, for ResNet-18 on Tiny ImageNet, the ASR rises from 39.3% at 2294 30 epochs to 90.0% at 150 epochs. For LLama-3b on SST-2, with epochs varying between 2 and 10, the ASR grows from 2295 40.19% to 83.5%. This trend underlines the importance of training duration in influencing the susceptibility of models to 2296 unlearning attacks. 2297

**Impact of learning rates.** Table 39 shows the influence of learning rate in our DDPA method by varying it from 0.001 to 0.1. We observed distinct trends between image classification and text classification models. For image classification models, ASR increases as the learning rate grows, whereas for text classification models, ASR starts to decrease with higher learning rates. This phenomenon can be intuitively explained as follows: a larger learning rate enables the algorithm to converge quickly to an optimal solution, which facilitates a higher attack success rate. However, for large-scale models like LLama-3b, an excessive learning rate may cause the optimization process to miss optimal solutions due to larger step sizes, leading to a decline in ASR. Therefore, it is crucial to determine an optimal learning rate to balance the effectiveness of the unlearning attack while maintaining the performance of the model.

**Influence of unlearning rates.** Table 40 demonstrates the impact of unlearning rate on our DDPA method by varying it from  $1 \times 10^{-5}$  to  $1.00 \times 10^{-3}$ . We observed that as the unlearning rate increases, the attack success rate (ASR) generally improves across all datasets and models. For instance, the ASR of VGG-16 on CIFAR-100 increases from 24.2% at  $1 \times 10^{-3}$  2310 to 92.0% at  $1 \times 10^{-5}$ . However, higher unlearning rates lead to a significant drop in both BA (balanced accuracy) and TA 2311 (training accuracy). This effect is particularly pronounced in the LLama-3b+SST-2 model, where the BA drops from 86.32% 2312 to 62.99% at an unlearning rate of  $1 \times 10^{-3}$ . In the targeted attack scenario, such a high unlearning rate disrupts the model's 2313 performance, compromising its generalization and accuracy. This highlights the need for carefully selecting the unlearning 2314 rate to balance effective unlearning with model robustness.

Table 37. ASR, BA, and TA for Different Models and Group Centers										
Model	Metric	Group Center								
		5	10	15	20	25				
	ASR	88.0	88.1	89.0	92.0	96.0				
VGG-16+CIFAR 100	BA	44.09	44.43	44.25	43.56	43.18				
	TA	94.54	95.60	95.89	95.48	95.81				
	ASR	86.0	88.0	90.0	91.0	95.4				
ResNet-18+Tiny Image Net	BA	33.53	33.06	32.10	33.11	34.18				
	TA	96.36	96.81	95.24	96.02	96.07				
	ASR	80.92	81.75	85.7	88.0	91.2				
LLama-3b+SST-2	BA	86.32	87.01	87.35	85.08	86.03				
	TA	92.45	93.14	92.97	91.14	92.38				

Table 38. ASR, BA, and TA for Different Models and Epochs

Model	Metric	Epochs							
		30	60	90	120	150			
	ASR	39.2	43.8	48.6	70.7	92.0			
VGG-16+CIFAR 100	BA	28.83	36.43	39.69	42.81	47.59			
	TA	56.68	84.4	91.79	89.49	98.23			
	ASR	39.3	45.2	65.2	83.1	90.0			
ResNet-18+Tiny Image Net	BA	25.51	34.68	36.53	40.48	43.24			
	TA	54.32	84.19	91.61	92.77	98.44			
	ASR	40.19	52.48	62.47	81.22	83.5			
LLama-3b+SST-2	BA	62.99	70.06	74.64	80.48	83.98			
	TA	78.78	83.26	85.44	90.48	91.06			

Table 39. ASR, BA, and TA for Different Models and Learning Rates

Model	Metric	Learning Rate							
		0.001	0.005	0.01	0.05	0.1			
	ASR	92.2	91.6	90.0	92.1	90.3			
VGG-16+CIFAR 100	BA	47.46	47.42	46.63	46.18	46.53			
	TA	98.35	98.75	98.06	98.45	98.32			
	ASR	90.3	88.2	89.9	92.3	90.6			
ResNet-18+Tiny Image Net	BA	43.9	43.61	42.82	42.29	40.21			
	TA	98.11	98.13	98.45	98.32	98.29			
	ASR	84.7	83.2	83.2	3.2	4.6			
LLama-3b+SST-2	BA	85.54	88.36	87.27	42.17	43.63			
	TA	95.18	96.1	96.33	61.7	50.92			

Table 40. ASR, BA, and TA for Different Models and Unlearning Rates										
Model	Metric	Unlearning Rate								
		1.00E-03	4.00E-03	1.00E-04	4.00E-04	1.00E-05				
	ASR	24.2	43.8	45.4	81.2	92.0				
VGG-16+CIFAR 100	BA	18.91	22.29	36.05	34.54	44.99				
	TA	28.61	36.75	67.34	81.18	94.54				
	ASR	22.8	40.1	57.2	78.3	88.0				
ResNet-18+Tiny Image Net	BA	11.59	20.33	32.29	33.53	35.62				
	TA	29.2	36.05	74.3	85.89	94.53				
	ASR	43.6	62.5	79.4	80.1	82.3				
LLama-3b+SST-2	BA	69.15	78.78	83.26	85.36	86.32				
	TA	52.95	62.99	70.06	88.42	92.45				