

What is the difference between **potential** and **accounting** methods on amortizing methods?

1. Accounting Method

- This method assigns a **charge (or credit)** to each operation.
 - Some operations may be **overcharged**, storing extra credit as a "prepaid" cost for future operations.
 - Other operations may be **undercharged**, using the stored credit.
 - The goal is to ensure that the **total amount charged** is always greater than or equal to the **actual cost**.
- ♦ **Example:** Suppose we perform a sequence of insertions in a dynamic array that doubles in size when full. We can charge extra in earlier insertions to cover the occasional resizing cost.

2. Potential Method

- This method defines a **potential function** Φ that represents the stored work (like energy) in the system.
- The amortized cost of an operation is calculated as:

$$\text{Amortized Cost} = \text{Actual Cost} + (\text{Change in Potential})$$

where:

$$\Delta\Phi = \Phi_{\text{after}} - \Phi_{\text{before}}$$

- If Φ decreases, it means we are using up the stored energy.
- ♦ **Example:** In a stack with an occasional "expensive" multi-pop operation, we can define a potential function based on the number of elements in the stack, which allows us to distribute the cost smoothly.

Key Differences

Feature	Accounting Method	Potential Method
Concept	Pre-charging expensive operations	Using a potential function to model work storage
Viewpoint	Assigns "credits" to operations	Tracks potential energy of the system
How it works	Overcharges cheap operations to pay for expensive ones later	Uses change in potential to adjust amortized cost
Ease of Use	More intuitive	More mathematical but rigorous

Both methods give the **same amortized time bounds** but approach the analysis differently.