**Exercise 4: Employee Management System**

**Scenario:**

You are developing an employee management system for a company. Efficiently managing employee records is crucial.

**Steps 1 : Understand Array Representation:**

* + **Explain how arrays are represented in memory and their advantages.**

Arrays are contiguous blocks of memory where each element can be accessed directly via an index. This allows for fast access and update operations, as the memory address of each element can be calculated. Arrays provide efficient use of memory and allow easy traversal.

**Advantages:**

* Direct access to elements via index.
* Efficient memory usage.
* Suitable for static datasets.

**Steps 2 : Analysis:**

* + **Analyze the time complexity of each operation (add, search, traverse, delete).**

**Add:** Adding an element at the end of the array is typically O(1) (amortized), assuming there's space

Adding an element at the beginning or middle is O(n) as elements need to be shifted.

**Search :** Linear search is O(n) in the worst case.

**Traverse** : Traversing the entire array is O(n).

**Delete** : Deleting an element generally involves shifting elements, resulting in O(n) time complexity.

* + **Discuss the limitations of arrays and when to use them.**

**Limitations:**

Fixed Size: The size of an array is fixed at creation, making it inflexible for dynamic data.

Inefficient for insertions and deletions: Inserting or deleting elements at the beginning or middle is expensive due to shifting elements.

Wastage of memory: If the array is not fully utilized, memory is wasted.

**When to Use Arrays**:

When the data size is known in advance and doesn't change frequently.

When random access is the primary operation.

When memory efficiency is critical and data structures with additional overhead (like linked lists) are not required.

For simple data structures where elements are of the same type.