**Task - 4 : Employee Management System**

Solution by: Mahika Thakur, CSE 7TH Semester, MCKV Institute of Engineering

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

Arrays in Memory:

Arrays are a fundamental data structure where elements are stored in contiguous memory locations.

Advantages of Arrays:

* Direct Access: Arrays provide constant-time access to elements using indices (O(1) time complexity for access).
* Simplicity: Arrays are easy to implement and use for a fixed number of elements.
* Memory Efficiency: There’s no overhead of extra memory for storing references or metadata, unlike linked lists or other complex data structures.

Limitations of Arrays:

* Fixed Size: Once an array is created, its size cannot be changed. This is a limitation if the number of employees varies dynamically.
* Insertion and Deletion: Adding or removing elements requires shifting elements, which can be inefficient (O(n) time complexity).

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

Time Complexity Analysis:

Add Employee: O(1) if there is space; otherwise, it’s O(n) if resizing is required, which is not handled here.

Search Employee by ID: O(n) as it requires a linear search through the array.

Traverse Employees: O(n) since every element needs to be accessed.

Delete Employee by ID: O(n) due to the need to shift elements after deletion.

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

Fixed Size: Use arrays when the number of records is known in advance and does not change frequently.

Dynamic Size Needs: For more dynamic needs, consider using other data structures such as ArrayList, which supports resizing and provides more efficient insertion and deletion operations.