Exercise 4: Employee Management System

Arrays in Memory

Arrays are a data structure that stores elements of the same type in a contiguous block of memory. Each element in the array can be accessed using its index, which is calculated based on the base address of the array and the size of each element.

Advantages of Arrays

Constant Time Access: Arrays allow O(1) time complexity for accessing elements by index.

Memory Efficiency: Arrays have low memory overhead because they don’t require additional memory for pointers or links.

Cache-Friendly: Contiguous memory allocation makes arrays cache-friendly, improving access times.

Time Complexity Analysis

Add Employee: O(1) on average, but O(n) in the worst case if resizing the array is necessary.

Search Employee: O(n) as it requires a linear search.

Traverse Employees: O(n) as it involves iterating over the array.

Delete Employee: O(n) as it involves a linear search to find the employee and shifting elements.

Limitations of Arrays

Fixed Size: Once an array is created, its size cannot be changed without creating a new array and copying elements.

Inefficient Insertions/Deletions: Insertions and deletions at positions other than the end are costly because elements need to be shifted.

Memory Waste: Allocating large arrays can lead to wasted memory if the array is not fully utilized.