Exercise 4: Employee Management System

A.Understand Array Representation:

1. Explain how arrays are represented in memory and their advantages.

In memory, an array is typically represented as a contiguous block of memory cells. The elements of the array are stored row by row, with each row occupying a continuous segment of memory. The memory map follows a row-major order, meaning that the elements of each row are stored together.

Advantages of Array:

Easy to use: Arrays are the simplest form of data structures and are easy to use. They allow us to store and access elements in a contiguous memory block.

Random access: Arrays allow us to access elements via their index randomly. This makes finding and retrieving data from an array much easier than with other data structures, such as linked lists or trees.

Flexibility: Arrays in Java offer a high level of flexibility when organizing data. Arrays can store any data, making them useful for storing and sorting large amounts of information. Also, arrays are dynamic, meaning their size can change at runtime. This allows programmers to easily add or remove elements from an array without altering the underlying code structure. As a result, developers have more freedom and control over how they use and manage their data sets.

Performance: The performance of the array is very good as it allows random access to the elements. As the elements are continuous blocks in memory, searching for an element can be done in constant time O(1) using index.

b.Analysis :

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

The time complexity of each operation is as follows:

1. For Adding an Element

Case 1: Adding to the End of the Array the time complexity is $O(1)$

Case 2: Adding to a Specific Position of the array the time complexity is O(n)

2. Searching for an Element

For Linear Search the time complexity is O(n)

For Binary Search the time complexity is O(logn)

3. For Traversing the Array the time complexity is O(n)

4. Deleting an Element

Case 1: For Deleting from a Specific Position the time complexity is O(n)

Case 2: For Deleting the Last Element the time complexity is O(1)

2. Discuss the limitations of arrays and when to use them.

The limitations of an array are the following:

-An array that is formed will be homogeneous. That is, in an integer array only integer values can be stored, while in a float array only floating value and character array can have only characters. Thus, no array can have values of two data types.

-While declaring an array, passing the size of an array is compulsory, and the size must be a constant. Thus, there is either shortage or wastage of memory.

-Shifting is required for insertion or deletion of elements in an array.