**Exercise 4: Employee Management System**

### Arrays in Employee Management

Arrays are a foundational data structure in programming, ideal for storing and managing fixed-size collections of elements such as employee records. Internally, arrays are stored as continuous blocks of memory, where each element occupies a uniform space and can be accessed directly using its index. This design supports fast access and a simple structure, making it appropriate for basic record management.

**Advantages of Arrays**

* **Constant Time Access (O(1))**: One of the biggest strengths of arrays is that any element can be accessed instantly using its index, without looping.
* **Memory Contiguity**: Arrays are allocated in a contiguous block of memory, resulting in more predictable and efficient memory usage.
* **Ease of Use**: Arrays offer straightforward declaration and manipulation, making them easy to implement in simple data storage systems.

**Operations and Time Complexity**

* **Add Operation**:
  + *Time Complexity*: O(1) if there is space available at the end of the array.
  + *Explanation*: The new employee record is simply inserted into the next available index.
* **Search Operation**:
  + *Time Complexity*: O(n), where *n* is the number of employees stored.
  + *Explanation*: Since the array is unsorted, you may need to check each element until a match is found.
* **Traverse Operation**:
  + *Time Complexity*: O(n)
  + *Explanation*: To display or perform an action on every employee record, each one must be visited sequentially.
* **Delete Operation**:
  + *Time Complexity*: O(n)
  + *Explanation*: Deletion involves shifting all elements after the removed element one position to the left, maintaining array continuity.

**Limitations of Arrays**

* **Fixed Capacity**: Arrays have a predetermined size. If the employee count exceeds the allocated space, a new array must be created and the data copied over.
* **Costly Deletions**: Deleting a record involves shifting all subsequent elements, which is inefficient for large datasets.
* **Linear Search**: Searching is not optimized unless the array is sorted or indexed, resulting in slower performance for large employee databases.

**When Arrays Are Suitable**

Arrays work well in employee management systems when:

* The number of employees is fixed or predictable.
* There is a need for quick access by index (e.g., for fixed employee ID mappings).
* Data modifications (like frequent insertions or deletions) are rare.
* A simple and efficient solution is preferred over dynamic or complex structures.