

# Data Structure Assignment – Theoretical Question

## Question:

What are the differences between Singly Linked List, Circular Linked List, and Doubly Linked List in terms of: Uses Pros Cons

### 1. Singly Linked List Uses:

- Used when memory is limited.
- Suitable for simple dynamic data storage.
- Used in stacks, queues, and adjacency lists.

### Pros:

- Requires less memory than doubly linked list.
- Easy to implement.
- Dynamic size.

### Cons:

- Traversal is only in one direction.
- Deleting a node requires access to the previous node.
- Reverse traversal is not possible.

## 2. Circular Linked List

### Uses:

- Used in applications that require continuous looping (e.g., CPU scheduling).
- Useful for implementing circular queues.

### Pros:

- No NULL pointers; last node points to the first node.
- Efficient traversal starting from any node.
- Suitable for round-robin algorithms.

### Cons:

- More complex implementation than singly linked list.
- Risk of infinite loops if not handled carefully.
- Harder to debug.

## 3. Doubly Linked List Uses:

- Used in navigation systems (back and forward).
- Used in undo/redo operations.
- Useful when bidirectional traversal is required.

### Pros:

- Traversal is possible in both directions.
- Deletion is easier since previous node is known.
- More flexible than singly linked list.

### Cons:

- Requires more memory due to extra pointer.
- More complex implementation.
- Slightly slower due to extra operations.

## Conclusion:

Each linked list type has its own advantages and disadvantages. The choice depends on the application requirements, memory usage, and traversal needs.

## Student Name:

زين العابدين علي محمد الضيفي