Q1) Time Complexity of Non-recursive & Recursive Merge Sort (5 marks)

Non-recursive Merge Sort

* Time Complexity: O (n log n)
* Uses a bottom-up approach with iterative loops
* Merges subarrays of increasing sizes (1,2,4,8...)

Recursive Merge Sort

* Time Complexity: O (n log n)
* Uses top-down approach with recursive calls
* Divides array into halves until size 1

Q2) Performance Differences (5 marks)

Although both have O (n log n) complexity, there are some differences:

1. Memory Usage

* Non-recursive uses less memory (no recursion stack)
* Recursive needs extra O (log n) stack space

2. Real Performance

* Non-recursive is usually faster because:
  + No function call overhead
  + Better cache performance
  + More predictable memory access