Zero variant, Algorithms and Data Structures, Azamat Serek

Theoretical Questions (70 points total)

1. Big O Notation: Define Big O notation and provide examples of common complexities (e.g., O(1), O(n), O(n^2)) (10 points).
2. Sorting Algorithms: Explain the differences between Bubble Sort, Selection Sort, and Insertion Sort. Discuss their time complexities (15 points).
3. Recursion: Describe how recursion works and provide a simple example of a recursive function (10 points).
4. MergeSort: Explain the MergeSort algorithm and its time complexity (10 points).
5. Dynamic Programming Introduction: What is knapsack problem and how it can be solved by dynamic programming? (10 points).
6. Search Algorithms: Compare Linear Search and Binary Search in terms of their time complexities and use cases (10 points).
7. Data Structures - Vectors: Discuss the characteristics of ArrayList in Java and its common operations (5 points).

Practical Question (30 points total)

8. Implement a Stack: Write a Java program that implements a stack using an ArrayList, including methods for push, pop, and peek (30 points).