**PRACTICAL EXAM – CSD201 – SPRING 2024**

**Duration: 85 minutes**

This assignment is designed to explore the management of a task dataset within an application framework. The dataset consists of tasks, each identified by an ID, description, and prioritized numerically. The tasks are as follows:

| **Task ID** | **Description** | **Priority** |
| --- | --- | --- |
| *1* | *Security patch for vulnerability* | *100* |
| *2* | *Add login feature* | *80* |
| *3* | *Update documentation* | *40* |
| *4* | *Fix email notification bug* | *90* |
| *5* | *Refactor user management module* | *70* |
| *6* | *Implement data caching* | *85* |
| *7* | *Optimize database queries* | *75* |
| *8* | *Write unit tests for new features* | *60* |
| *9* | *Upgrade third-party libraries* | *50* |
| *10* | *Review and merge pull requests* | *55* |

1. Implement a ***Task*** class encapsulating ***ID***, ***description***, and ***priority*** attributes. Include a ***compareTo*** method to facilitate task comparison based on priority between tasks.[1 marks]
2. Write a ***main*** function in which initialises an array ***Task[] tasks*** to hold this dataset of tasks, then demonstrate by print out tasks.[1 marks]

Discuss the advantages and disadvantages of using an array for task management, focusing on access, insertion, deletion, and search operations, by comment in code. [1 marks]

1. Still in the main function, implement the ***MergeSort*** algorithm, to sort this array of ***Task*** objects by using the ***compareTo*** method for comparison( based on the priority of the tasks) [2.5 marks]

Why is ***MergeSort*** stable and why is ***Quicksort*** not stable? [0.5 marks]

1. Implement a max heap data structure ***class MaxHeap*** for efficient task prioritization, with ***void insert(Task element)*** method inserting tasks in a way that maintains the heap's property and ***Task remove()*** method removing and returning the maximum element from the heap. [2.5 marks]

Which are the main advantages of heap data structure?[0.5 marks]

1. Now in the main function, Initialize a ***MaxHeap*** object, insert tasks into the heap individually, then remove and display each by using the heap's remove function.[1 marks]

Note: Submit 1 java file only!