B.Sc. Engg. SWE 5th Semester 04 October 2023 (Morning) 21

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

Department of Computer Science and Engineering (CSE)

MID SEMESTER EXAMINATION **WINTER SEMESTER, 2022-2023**
DURATION: 1 HOUR 30 MINUTES **FULL MARKS: 75**

SWE 4501: Design Patterns

Programmable calculators are not allowed. Do not write anything on the question paper.

Answer **all 3 (three)** questions. Figures in the right margin indicate full marks of questions whereas corresponding CO and PO are written within parentheses.

1. a) What are the main components of OOP? Explain the statement "classes should be open for extension and closed to modification" with a proper example. 4 (CO1) (PO1)

   b) Consider each of the scenarios of question 1.b) seperately. Write down the name of the design patterns or principle that would be most useful for addressing those scenarios. Explain the reason for choosing a pattern or principle. 3 × 3 (CO3) (PO2)

      i. You are developing a system that relies on a complex algorithm and that algorithm may be changed often due to different marketing situations.

      ii. A pizza factory produces pizzas with various toppings. There are 20 different toppings. A customer may order any combination of those toppings. Assume that each of the pizza breads and toppings will be represented by seperate classes.

      iii. You are developing a cricket application that notifies viewers about various information, such as current score, run rate, etc. Suppose we have made two display elements, `CurrentScoreDisplay` and `AverageScoreDisplay`. `CricketData` has all the data (runs, overs etc.) and whenever data change, the display elements are notified with new data and they display the latest data accordingly.

   c) Explain a scenario where Template Pattern can be used. Write the corresponding code for that scenario. Also, draw the UML diagram for that scenario. 12 (CO4) (PO1)

2. a) Briefly explain the purpose of the Decorator pattern. Write down three distinct advantages of factory methods over constructors. 5 (CO3) (PO1)

   b) Imagine a situation where you have a software that implements an online store that sells knives called *'KnifeStore'*. The software produces `Steakknives` and `Chefsknives`. The methods of sharpening, polishing, and packaging would remain in the `orderKnife` method. However, the responsibility of creating the product will be delegated to another object: a `KnifeFactory`. Subclass of the `KnifeFactory` called `BudgetKnifeFactory` would make `BudgetChefKnife` and `BudgetSteakKnife` product objects. Subclass of the `KnifeFactory` called `BasicKnifeFactory` would make `BasicChefKnife` and `BasicSteakKnife` product objects. 20 (CO4) (PO1)

      Write the code implementation of the above scenario using an appropriate pattern and draw the UML diagram of your implementation.

3. a) Which design pattern "works as a bridge between two incompatible interfaces"? Explain the intent and motivation of this pattern. 2 + 3 (CO3) (PO1)

b) We use the term "program to an interface, not to an implementation". Explain a pattern satisfying the statement with real world scenario. Draw the UML Diagram for that scenario. 6 + 6 (CO3) (PO1)

c) Differentiate between the following concepts/patterns: 2 × 3 (CO3) (PO1)

   i. Prototype and Singleton
   ii. Strategy and Decorator
   iii. Coupling and Cohesion