B.Sc. Engg. SWE 5th Semester

06 November 2022

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

Department of Computer Science and Engineering (CSE)

SEMESTER FINAL EXAMINATION

WINTER SEMESTER, 2021-2022

DURATION: 3 HOURS

FULL MARKS: 100

SWE 4501: Design Pattern

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

Answer all 6 (six) questions. Marks of each question and corresponding CO and PO are written in the right margin with brackets.

1. a) What are the main components of OOP? Discuss the advantage and disadvantage of using Composition over Inheritance. 1+2 (CO1) (PO1)

   b) Indicate for each case which design pattern you will use: 6 (CO4) (PO2)
      i. Be able to replace the implementation of an interface at run time.
      ii. Decoupling clients of a system X from dependencies on subsystems of X.
      iii. Providing clients with a reference to an object of type X but defer the creation of an expensive object of type X until it is needed.
      iv. Defining a new operation without changing the classes of the elements on which it operates.
      v. Restoring state of an object to a previous state.
      vi. Promoting invocation of a method on an object.

   c) Hollywood principle states that "Don't Call Us, We'll Call You". Identify a pattern satisfying this principle. Write a code example for that pattern and explain how your code satisfies this principle. 1+4+4 (CO4 (PO2

2. a) What are the relationships between the Facade and Abstract Factory pattern? 4 (CO3 (PO2

   b) 1 (CO4 (PO2

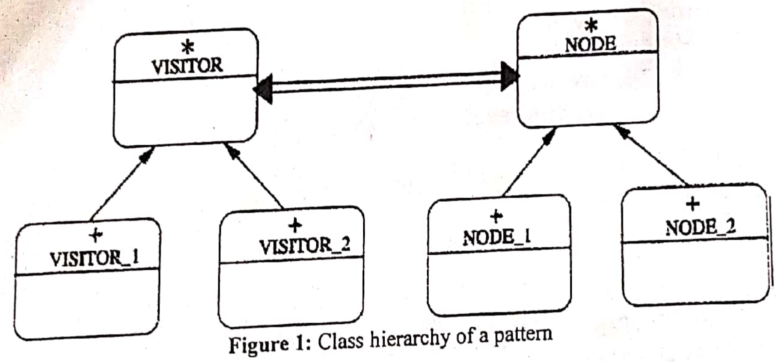

Figure 1: Class hierarchy of a pattern

Answer the following questions according to Figure 1.

i. Describe the features required in each deferred class, and a typical effective class in each hierarchy, to support the pattern.

ii. Suppose a class, NODE_C is added as a subclass of NODE. List and describe the required changes to all of the classes affected by the addition.

iii. Would you advise using the Visitor Pattern if the NODE hierarchy is changed frequently? Justify your answer.

iv. Describe the type of applications that are suitable for the Visitor Pattern.

v. Explain the term *"Double Dispatch"* in Visitor Pattern.

3. a) An application for optimizing nurse rosters contains persons and shifts. A person has a number of shifts in his roster, and each shift may be divided into several sub-shifts. You are part of a group tasked to build a general roster traversal algorithm that will generate new rosters based on existing ones.

   i. Draw a UML diagram representing people, rosters, shifts, and sub-shifts.

   ii. How would you traverse rosters to summarize shift times? Provide code/ pseudo code of your implementation.

   iii. Name relevant design patterns used as part of your design and explain how they are used.

b) Perform a comparative analysis among Singleton, Prototype and Flyweight. 5 (CO3) (PO1)

4. a) Use Composite Pattern to model the notion of a folder in Windows XP. Folders may be nested and may also contain text files and binary files. Files may be opened, closed, or drawn on the screen. Folders may also have items added and removed from them. Draw the UML diagram for the described model. 5 (CO4) (PO1)

b) Which design pattern restores the state of an object to a previous state? Write a code example of restoring a previous state of an object. 5 (CO4) (PO1)

c) Describe the intent and motivation of Builder pattern. What are the differences between Builder and Factory Pattern? 2+2 (CO3) (PO1)

a) Draw a UML diagram for Mediator pattern between web services and web clients. As web services, the eBay auction house and Amazon are available. Plan functions to search for an item with a textual description, and to buy an item from the service that gives the best price. 5 (CO4) (PO2)

b) Identify two design patterns which reduce memory footprint. Perform comparative analysis between them. 5 (CO4) (PO2)

c) Identify a pattern which decouples an abstraction from its implementation so that the two can vary independently. Explain a scenario satisfying the statement. 5 (CO4) (PO2)

a) Write short notes on – "Refused Bequest" and "Large Class". 5 (CO2) (PO1)

b) Consider the following code snippets – 5×3 (CO2) (PO2)

```
public class Rental {
    private Movie _movie;
    Private int  _daysRented;

   public Rental (Movie movie, int daysRented) {
      _movie = movie;
      _daysRented = daysRented
   }

   public int getDaysRented() {
   return _daysRented;
   }

  public Movie getMovie() {
     return _movie;)
  }
```

```
        //determine amounts for each line
        switch (getMovie().getPriceCode()) {
            case Movie.REGULAR:
                thisAmount += 2;
                if (getDaysRented() > 2)
                    thisAmount += (getDaysRented() - 2) * 1.5;
                break;
            case Movie.NEW_RELEASE:
                thisAmount += getDaysRented() * 3;
                break;
            case Movie.CH1LDRENS:
               thisAmount += 1.5;
               if (getDaysRented() > 3)
                    thisAmount += (getDaysRented() - 3) * 1.5;
                break;
      }
      return this.Amount; }
}

public class Movie {
    public static final int CHILDRENS = 2;
    public static final int REGULAR= 0;
    public static final int NEW_RELEASE = 1;

    private String _title;
    private int _priceCode


    public Movie (String title, int priceCode) {
        _title = title;
        _priceCode = priceCode;

     public int getpriceCOde() {
            return _priceCode;
        }
        public void setPriceCode(int arg) {
            _priceCode = arg;
        }
        public String getTitIe {
            return _title;
        }
}
```

i. Briefly explain the terms “Code refactoring” and “Code smell”.

ii. Identify two code smells which have occurred in the code.

iii. Refactor the code by removing the smells.