PES University, Bengaluru

(Established under Karnataka Act 16 of 2013)

END SEMESTER ASSESSMENT (ESA) - May 2023

UE20CS352 - Object Oriented Analysis & Design with Java

Total Marks : 100.0

1.a. Draw the Class Diagram to model a system for management of courses and enrolments. Identify classes, attributes, relationships and cardinality.

1. A Department manages multiple Sessions.
2. A Session has a Start date, an End date and Name (like Jan-May 2023).
3. A session can have multiple semesters running (like 6th, 4th, 2nd etc).
4. A student belongs to a semester and to a section within it. A section has minimum of 60 students.
5. A semester has a set of courses offered in it.
6. A student has to enrol for all the required number of courses (let us assume 5 for the listed semesters). For some courses like electives, a minimum of 20 students have to enrol for it to be offered.
7. An enrolled student's attendance for the course is recorded.
8. Similarly, an enrolled student's ISA, ESA marks and Grade for the course are recorded.
9. A teacher will be assigned to a section for a course.
10. A teacher can also be assigned as the class teacher for a particular section

Note: Assume attributes and other details as appropriate. (6.0 Marks)

1.b. For the given scenarios, choose appropriate diagram to model the scenario. Justify your choice and draw the chosen diagram for the scenario.

i) Every student is assigned a Faculty Advisor. The Faculty Advisor is assigned a minimum of 25 students with no maximum limit.

ii) An Order consists of multiple Items. The Order total is computed by adding the product of Quantity and Price for each Item in the Order. (6.0 Marks)

1.c. Write short notes about the following features of a **State diagram** with appropriate notations and an example.

i) Order of activities associated with a state transition

ii) Synchronization and Splitting associated with concurrent states (4.0 Marks)

1.d. Write about the elements in a Component Diagram. Represent the same in an example diagram using the correct notations.

(4.0 Marks)

2.a. What are the three types of constructors that can be defined in Java? Give an example of each. (6.0 Marks)

2.b. Using method overloading in Java, write a class NextValue with a method getNextValue that takes either interger or float as input and returns next integer in case the parameter is integer or returns a float value by adding 0.01 in case of float input.

Write the main method that calls the method with different parameters.(4.0 Marks)

2.c. Write Java code for the given scenario.

1. The SHIELD assigns the Avengers to a Mission.
2. The Mission has a name, location, strength requirement and list of Avengers assigned.
3. An Avenger has name, weapon and strength level.
4. The addAvenger method in Mission, takes a list of all Avengers, iterates through the list and assigns all those Avengers to the Mission who has a strength level greater than the Mission's strength requirement.
5. The showMission method should display the Mission details and list of Avengers assigned using System.out.println(avenger) directly.

The main method is given below for your reference with the Expected Output.

```
public class MissionMain {
    public static void main(String[] args) {
        Avengers ironMan = new Avengers("Iron Man", "Suit", 9);
        Avengers thor = new Avengers("Thor", "Hammer", 10);
        Avengers captainAmerica = new Avengers("Captain America", "Shield", 8);
        Avengers blackWidow = new Avengers("Black Widow", "Guns", 7);

        List<Avengers> avengersList = new ArrayList<>();
        avengersList.add(ironMan);
        avengersList.add(thor);
        avengersList.add(captainAmerica);
        avengersList.add(blackWidow);

        Mission mission = new Mission("Save the World", "New York", 9);
        mission.addAvenger(avengersList);
        mission.showMission();
    }
}
```

Expected Output:

```
Save the World New York 9
Iron Man Suit 9
Thor Hammer 10
```

(8.0 Marks)

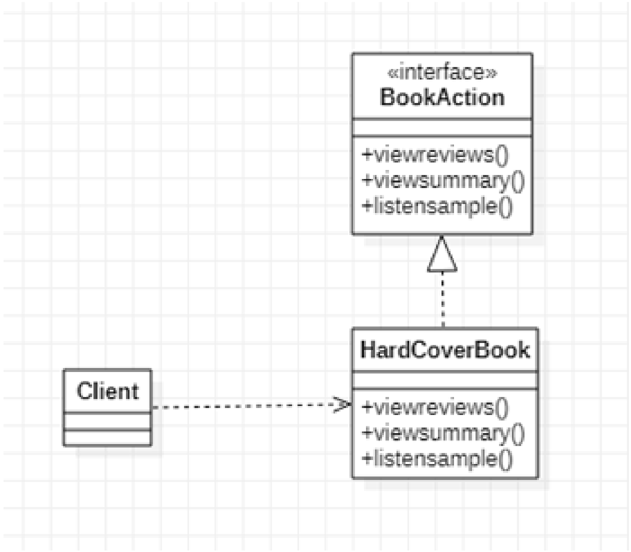
2.d. Is the below statement valid in Java? Justify your answer.

```
Object o = new ArrayList<String>();
```

(2.0 Marks)

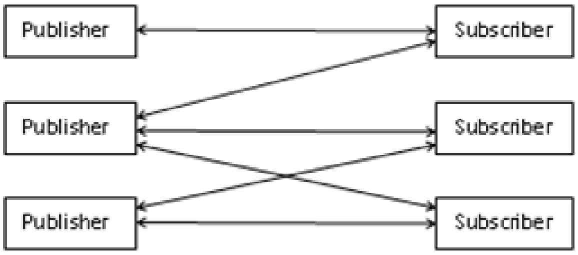
3.a. Identify the three SOLID principles violated by this design. Suggest correction so that the violated principles are adhered to.

(6.0 Marks)



3.b. What is wrong with the model given below in terms of GRASP design principles? Show how can this be improved with a structural diagram.

(6.0 Marks)



3.c. With a neat flow diagram, explain the working of MVC architecture pattern.

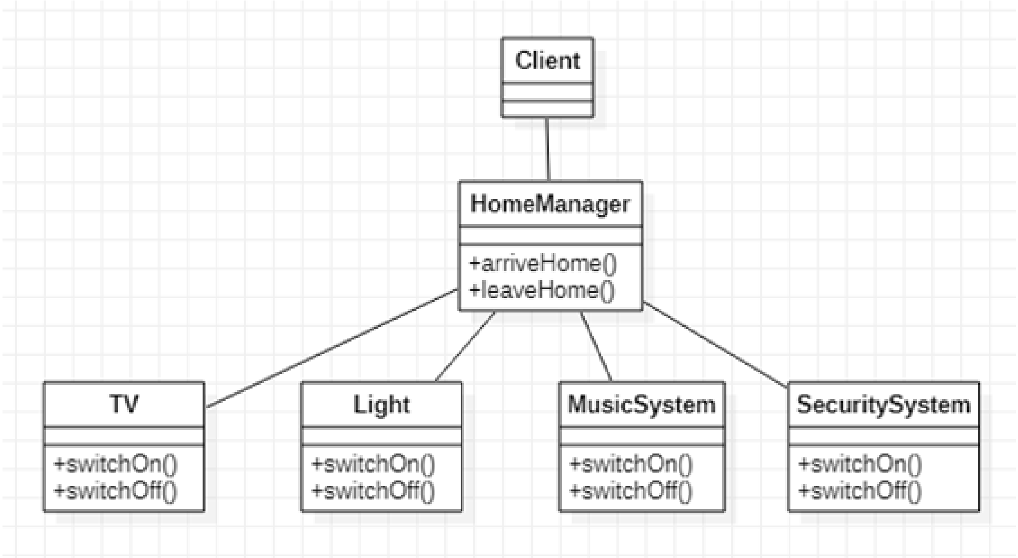
(4.0 Marks)

3.d. Explain the Liskov Substitution Principle using an example where LSP is violated and how it can be corrected. (4.0 Marks)

4.a. Describe the Factory Method creational pattern with a suitable example design and corresponding code snippet. (6.0 Marks)

4.b. Identify the structural pattern being used in the design diagram below. Justify. Write code to implement the HomeManager class constructor and methods.

(6.0 Marks)



4.c. Implement the following use case using a proxy pattern. Write both the class diagram and the code snippet. State which type of proxy pattern is suitable for the given use case.

Use Case:
If an entire library of songs, with all the details about each song, is loaded from a database, it will consume a lot of RAM, and it is very likely that the user will need to play *only* one song. The solution displays only the *title*, *artist*, and *duration* of the songs when a list of them is displayed. When a song is selected, the corresponding media stream will be fetched from the database and operations like play can be performed.

Note: do not write the entire code; write only code snippets/pseudo code to instantiate and use the proxy and the real object. (6.0 Marks)

4.d. Fill in the blanks.

i) ______________________ pattern refers to creating duplicate object while keeping performance in mind.
ii) ______________________ pattern provides the interface according to client requirement while using the services of a class with a different interface (2.0 Marks)

5.a. Describe the structure of the solution for **Iterator** pattern. (4.0 Marks)

5.b. Implement the following use case using a Chain of Responsibility pattern. Write both the class diagram and the code snippet for building the chain.

A logging system provides functionality to write INFO messages to the console (terminal), ERROR messages to an error log file and DEBUG messages to a debug log file. The client invokes the console logger irrespective of the type of message. The console logger will check the type and if the message is INFO message then it writes it to the console. Else, it invokes the next level logger that is the error logger. The error logger does the same and if the message is not an ERROR message it invokes the debug logger. The same applies to DEBUG logger, however, it does not have any next level logger. (6.0 Marks)

5.c. Explain with an example the steps for the refactored solution for the Blob Anti-pattern. (6.0 Marks)

5.d. Mention any two symptoms and any two typical causes for Analysis Paralysis design anti-pattern. (4.0 Marks)