Xi'an Jiaotong-Liverpool University
西交利物浦大学

Module Code	Examiner	Academic Unit	Tel
CPT203		CPT	

1st SEMESTER 2022/23 FINAL EXAMINATION

Undergraduate – Year 3

Software Engineering 1

Exam Duration: 2 Hours

INSTRUCTIONS TO CANDIDATES

1. **This is a closed-book examination, which is to be written without books or notes.**

2. **Total marks available are 100.**

3. **This exam consists of two sections:**

    Section A consists of SIX questions for a total of 55 marks.

    Section B consists of THREE systems modelling questions for a total of 45 marks.

    Answer all questions. There is NO penalty for providing a wrong answer.

4. **Only English solutions are accepted.**

5. **All materials must be returned to the exam invigilator upon completion of the exam. Failure to do so will be deemed academic misconduct and will be dealt with accordingly.**

Section A – Answer all questions below (55 marks):

Question A.1 (7 marks)

Software development is one of the elements in the development of autonomous vehicles. The waterfall software process model is considered most suitable for such a system.

a. Identify ONE reason to use the Waterfall model. (2 marks)

b. When the project is in the Software Design and Implementation stage, in theory, the project team should not revisit the Software Specification stage. In practice, the project team may step back to the Software Specification stage for some strong reasons. Name ONE of the possible consequences if the project team decided to revisit the Software Specification stage.   (2 marks)

c. If, for any reason, the project team decided to revisit the Software Specification stage, what measures should be in place to reduce the negative impacts on the project? (3 marks)

Question A.2 (6 marks)

a. One of the principles underlying agile methods is "Customer collaboration over contract negotiation". State one obvious evidence where Scrum framework complying with this principle. (3 marks)

b. In Scrum framework, the Scrum team specifies user requirements in Product Backlog Item (PBI). One of the popular formats for writing PBI is User Story. Below is the Acceptance Criteria for a User Story named "Change UI Language", what is missing in the Acceptance Criteria?   (3 marks)

> **Acceptance Criteria:**
> *When a user clicked on the "Change Language" button, a change language dialog box with a list of available languages should be displayed on the center of the screen.*

Figure 1: Acceptance Criteria

Question A.3 (7 marks)

An automated ticket-issuing system sells rail tickets. The user selects his destination and inputs a credit card and a personal identification number. The rail ticket is issued and charged to their credit card account.

To begin, the user presses the start button. The system activates a menu displaying the potential destinations and sends a message to the user to select a destination. Once the user selects a destination, the system requests the user to insert his credit card. The system checks the credit card validity and requires the user to input a personal identifier. When the credit transaction is validated by the credit card center, the ticket is issued. If the user enters an invalid personal identifier for the credit card, the system will prompt the user and terminate the transaction.

    a. The above statement is extracted from a customer during requirement discovery. If the requirements are recorded in the below Structured Requirement Form, which row should you record: -

        I.   *"If the user enters an invalid personal identifier for the credit card, the system will prompt the user and terminate the transaction."*   (2 marks)

        II. *"Ticket is dispensed; credit card account is charged; transaction is recorded."* (2 marks)

    b. Apart from the "user", who is the second actor in the requirement?   (3 marks)

Function name	
Description	
Actor(s)	
Pre-condition	
Post-condition	
Main scenario	
Exception	

Figure 2: Structured Requirement Form

Question A4 (12 marks)
List and explain the FOUR steps of Project Risk Management. (12 Marks)

Question A5 (12 marks)

a. A well-formed design class should have four characteristics including: complete and sufficient, primitiveness, high cohesion, and low coupling. Please explain any THREE of these four characteristics. (6 marks)

b. Consider the following class diagram of a system in a library. The stakeholders have requested several operations to include in the system, as listed in the table below. Re-draw the class diagram to include the operations listed in the table. Your new class diagram must exhibit highly cohesive classes (6 marks).

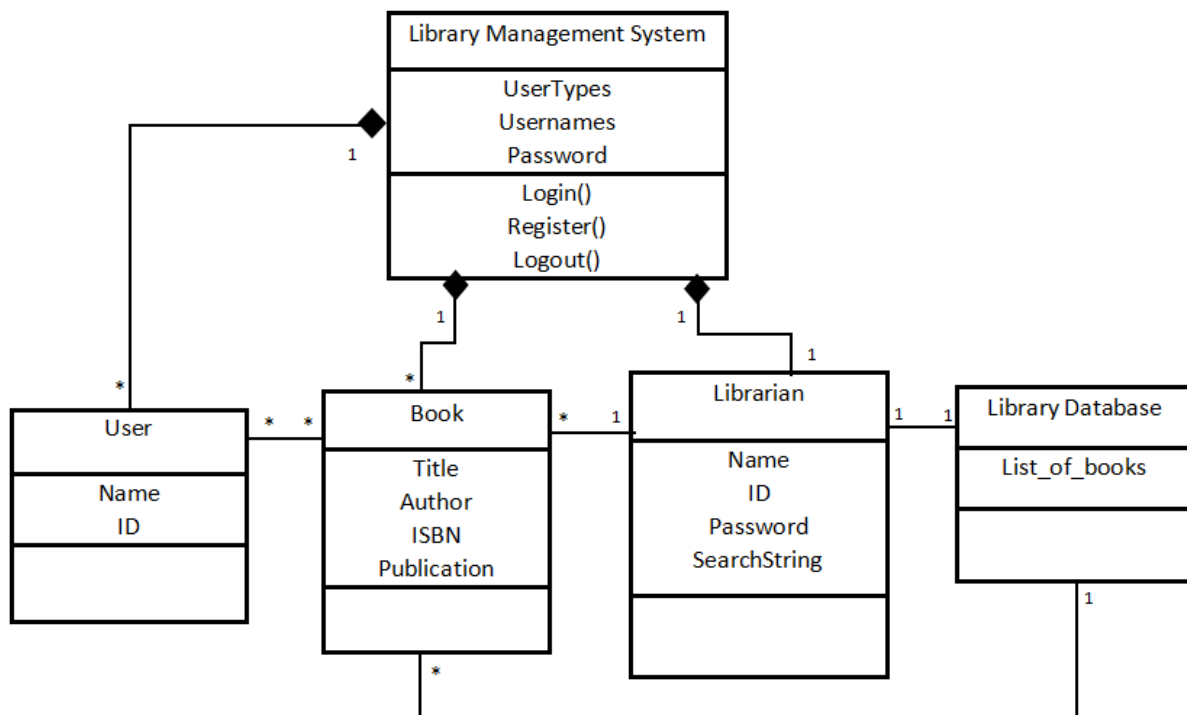| Operations	Descriptions
Book_request	Request the book(s) from the library
Reservation_status()	Display the reservation status of a book
Feedback()	Show the feedback/comments for a book
Add()	Add book(s) to the library
Delete()	Delete book(s) to the library
Update()	Update the information of the book(s) in the library

Figure 3: Class Diagram for Library System

Question A6 (11 Marks)

a. Describe the 3 stages of software testing (6 marks)

b. Refers to the Grade Class below. Please write a Junit unit test for the following cases: (5 marks)

- Use 72 as the test case
- Test a case that fails the function

```
public class Grade {
    public static char getLetterGrade(int mark) {
        if (mark >= 75) {
            return 'A';
        } else if (mark >= 60) {
            return 'B';
        } else if (mark > 50) {
            return 'C';
        } else {
            return 'F';
        }
    }
}
```

Figure 4: Grade Class

Question B.1 (15 marks)

A simple Product Management System has the following requirements: -

1. The user can add a new product to the system. He can edit the product; and delete the unwanted product.
2. Each product belongs to a category. For example, "Ribeye Steak" is categorized as the "Meat" category.
3. The user can change the selling price of the product. When changing the selling price, we must keep the old price as a History Selling Price. Each product has a list of its History of Selling Prices. With each History Selling Price, you can find a date indicating the last day of the price's validity. History Selling Price is part of the product; when a product is no longer needed, we must also delete the related History Selling Price.
4. Users can add media to the product to aid marketing and promotion activities. He must add at least one media file to each product. There are currently two types of media available, video and photo. Media files are part of the product; when a product is no longer needed, we must also delete the media files.

Your task is to draft a class diagram to model the above requirements and answer the questions below.

a) One of the above-listed requirements is, "Each product belongs to a category"; if an additional fact, "Each category has many products." is given, illustrates the relationship and multiplicities between them using a class diagram. (3 marks)
b) Assuming you've identified Product and History Selling Price as two of the classes, illustrate the relationship and multiplicities between them using a class diagram. (4 marks)
c) Assuming you've identified Product and Media as two of the classes, illustrate the relationship and multiplicities between them using a class diagram. (4 marks)
d) As mentioned in the requirements, video and photo are two types of media. Illustrate the relationship between them using a class diagram. (4 marks)

Question B.2 (15 marks)

A software company designs the following process to resolve issues found in its software.

1. The party who discovered an issue in the software creates a problem ticket to describe the issue.
2. An engineer will reproduce the issue according to the description in the problem ticket. If the engineer cannot reproduce the issue, he will update the problem ticket to request more descriptions for the issue.
3. When the party who discovered the issue provides more description, the engineer will reproduce the issue again.
4. After successfully reproducing the issue, the engineer identifies the issue. If it is a known issue, the engineer will update the problem ticket with the solution and close the problem ticket to end the process. If it is a new issue, the engineer will work out the solution. Next, the engineer will verify the solution.
5. If the solution is successful, the engineer will update the problem ticket with the solution and close the problem ticket to end the process.
6. If the solution is verified to be unsuccessful, the engineer will identify the issue again.

Your task is to draft an activity diagram to model the above requirements and answer the questions below.

a) If the activity diagram is drawn with swimlanes, name TWO actions that should be in the Ticket Creator's swimlane. (2 marks)
b) How many decision nodes have you identified in your draft activity diagram? (2 marks)
c) If the issue is a known issue, how should the engineer handle the rest of the process? Illustrate your answer using an activity diagram. (3 marks)
d) After the solution is verified as successful, how should the engineer handle the rest of the process? Illustrate your answer using an activity diagram. (3 marks)
e) If the solution is verified as unsuccessful, the process will enter a loop. Draw the activity diagram to illustrate the loop. (5 marks)

Question B.3 (15 marks)

A school needs to register students in its new system. The system has a controller object that accepts all requests from the user. Each student object contains the student's name and age. A list will contains all the student objects representing students in the school. The user can request the system to register a student, and to search for a student by student name. The figures below is the Java source code for the system.

You are required to draft a sequence diagram for the **Register** function and draw the fragment of the sequence diagram that: -
   a) Represent *Student student = new Student()*. (2 marks)
   b) Illustrate the interaction between **StudentController** class and **studentList** object. (4 marks)
   c) Illustrate *student.setName(name)*. (3 marks)
   d) Illustrate *boolean success = studentList.add(student)*. (6 marks)

```java
1    package com.cpt203.exam.controller;
2
3    import java.util.*;
4    import com.cpt203.exam.model.Student;
5
6    public class StudentController {
7        private List<Student> studentList = new ArrayList<Student>();
8
9        public boolean register(String name,int age){
10           Student student = new Student();
11
12           student.setName(name);
13           student.setAge(age);
14
15           boolean success = studentList.add(student);
16
17           return success;
18       }
19
20       public Student searchByName(String name){
21           Student foundObject = null;
22           for(int i = 0; i < studentList.size() && foundObject == null; i++){
23               if(studentList.get(i).getName().compareTo(name) == 0){
24                   foundObject = studentList.get(i);
25               }
26           }
27
28           return foundObject;
29       }
30   }
```

Figure 5: Java source code for the controller

```java
1    package com.cpt203.exam.model;
2
3    public class Student {
4        private String name;
5        private int age;
6
7        public Student() {
8        }
9
10       public Student(String name, int age) {
11           this.name = name;
12           this.age = age;
13       }
14
15       public String getName() {
16           return this.name;
17       }
18
19       public void setName(String name) {
20           this.name = name;
21       }
22
23       public int getAge() {
24           return this.age;
25       }
26
27       public void setAge(int age) {
28           this.age = age;
29       }
30   }
```

Figure 6: Java source code for the student class

The end of the paper