

NANYANG TECHNOLOGICAL UNIVERSITY**SEMESTER 1 EXAMINATION 2022-2023****CE2002/CZ2002/SC2002 – OBJECT ORIENTED DESIGN & PROGRAMMING**

Nov/Dec 2022

Time Allowed: 2 hours

INSTRUCTIONS

1. This paper contains 4 questions and comprises 6 pages.
2. Answer **ALL** questions.
3. This is a closed-book examination.
4. All questions carry equal marks.

1. (a) What do you interpret about **System** and **out** in the statement below?
System.out.println("Welcome to NTU!");
(5 marks)
- (b) List **THREE** differences between *method overloading* and *method overriding*.
(6 marks)
- (c) Explain the object-oriented feature *Encapsulation/Information Hiding*. List **TWO** benefits of this feature. Elaborate how this feature is achieved in Java programming.
(8 marks)
- (d) List **THREE** differences between *static method* and *instance method*.
(6 marks)

2. Study the partial UML class diagram in Figure Q2.

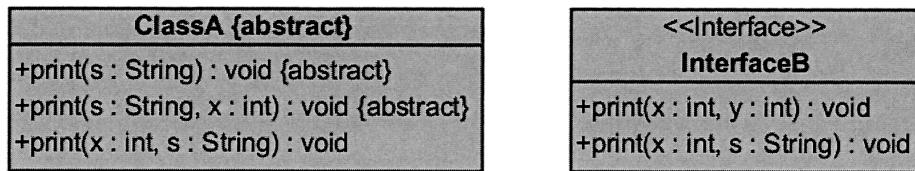


Figure Q2

- (a) Draw the **COMPLETE** class diagram by adding the following **CLASSES** (with their necessary methods) into the partial diagram in **Figure Q2**:

- ClassC implements InterfaceB, and provides implementation for all the necessary methods.
- ClassD inherits ClassA, and contains only one method with implementation, which is the print (s: String) method.
- ClassE inherits ClassA, and implements InterfaceB. It provides implementation for the print (x: int, y: int) method. It does not contain any other method.
- ClassF inherits ClassD, and provides implementation for all the necessary methods.
- ClassG inherits ClassE, and provides implementation for all necessary methods.

(10 marks)

- (b) Write the **Java** code for all the **CLASSES** in the complete class diagram and their methods. Note that the print methods in all the classes simply print out the values of their parameters.

(10 marks)

- (c) Explain the outcome, the class's method called or used (if any) and the type of casting (if any) for **each line** of the following codes during **compile-time** and **runtime**.

```

ClassA a = new ClassG();
a.print("100", 100);
ClassE d = (ClassE)a;
d.print("100", 100);

```

(5 marks)

3. (a) Study the following description of a simplified Final Year Project (FYP) system.

- FYP is an individual work.
- Project information only contains projectID, supervisorID, studentID, projectTitle, and area.
- The projects fall in one of the following three areas: Hardware, Software, and Research. A project only belongs to one area.
- A project is created by a faculty. Once a faculty submits a new project title to the FYP system, the supervisorID will be the faculty's userID and projectID will be an automatically generated sequential index.
- The users can login to the FYP system using userID and password. The users include faculty, students, and FYP coordinator, who is a faculty as well.
- A student can view the detailed information of his/her registered project.
- A supervisor can view the information of all the projects under his/her supervision.
- A supervisor can modify the title and area of all the projects under his/her supervision.
- Only the FYP coordinator can assign a project to a student.
- Only the FYP coordinator can change supervisor of a project. When a supervisor is leaving NTU, the FYP coordinator will find a faculty in the same area with light workload to be the replacement supervisor.
- The users can communicate via Email, Teams, and Phone call.

You are tasked to identify the classes needed to build the application based on the description above.

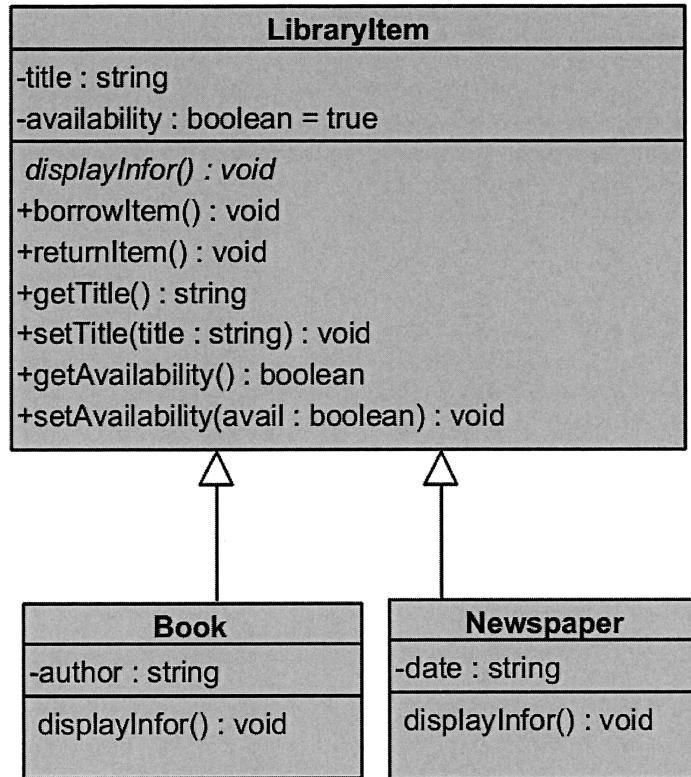
Show your design with a Class Diagram. Your Class Diagram should show clearly the relationships between classes, enumeration, relevant attributes, necessary class methods, logical multiplicities, meaningful role names, association names, and constraint(s), if any.

(18 marks)

(b) Explain your application of **TWO** of the **SOLID** design principles in your class diagram design in 3(a).

(7 marks)

4. The UML Class Diagram in Figure Q4 shows the relationships of **THREE** classes : LibraryItem class, Book class, and Newspaper class. Study carefully the class diagram and the details depicted.

**Figure Q4**

Assume there is only one book and one newspaper in the library at this moment. Please write C++ code for the simple library system.

- Write C++ code for the **THREE** classes.
 - Separate the declaration code and implementation code – create a header file/s (.h) for the declaration code and implementation file/s (.cpp) for the implementation code.
- Write the **libraryMain.cpp** for a complete implementation.

A sample run of the library is shown below:

Enter libraryItems:

Enter Book Author Name:

William Tan

Enter Book Title Name: C++

Enter Newspaper Date: 2022-09-27

Enter Newspaper Title Name: Straits Times

Note: Question No. 4 continues on Page 5

MENU

- 1. Borrow Book**
- 2. Return Book**
- 3. Borrow Newspaper**
- 4. Return Newspaper**
- 5. Exit**

Enter your Choice: 1

Book title: C++ Author: William Tan

Borrow Item successfully.

MENU

- 1. Borrow Book**
- 2. Return Book**
- 3. Borrow Newspaper**
- 4. Return Newspaper**
- 5. Exit**

Enter your Choice: 1

Book title: C++ Author: William Tan

Item is on loan.

MENU

- 1. Borrow Book**
- 2. Return Book**
- 3. Borrow Newspaper**
- 4. Return Newspaper**
- 5. Exit**

Enter your Choice: 2

Book title: C++ Author: William Tan

Thank you for returning the Item.

MENU

- 1. Borrow Book**
- 2. Return Book**
- 3. Borrow Newspaper**
- 4. Return Newspaper**
- 5. Exit**

Enter your Choice: 4

Newspaper title: Straits Times Date: 2022-09-27

The Item is not on loan.

Note: Question No. 4 continues on Page 6

MENU

- 1. Borrow Book**
- 2. Return Book**
- 3. Borrow Newspaper**
- 4. Return Newspaper**
- 5. Exit**

Enter your Choice: 3

Newspaper title: Straits Times Date: 2022-09-27

Borrow Item successfully.

MENU

- 1. Borrow Book**
- 2. Return Book**
- 3. Borrow Newspaper**
- 4. Return Newspaper**
- 5. Exit**

Enter your Choice: 6

Invalid Choice Entered

MENU

- 1. Borrow Book**
- 2. Return Book**
- 3. Borrow Newspaper**
- 4. Return Newspaper**
- 5. Exit**

Enter your Choice: 5

Thank you for using the library system.

(25 marks)

END OF PAPER

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Please read the following instructions carefully:

- 1. Please do not turn over the question paper until you are told to do so. Disciplinary action may be taken against you if you do so.**
2. You are not allowed to leave the examination hall unless accompanied by an invigilator. You may raise your hand if you need to communicate with the invigilator.
3. Please write your Matriculation Number on the front of the answer book.
4. Please indicate clearly in the answer book (at the appropriate place) if you are continuing the answer to a question elsewhere in the book.