Beijing-Dublin International College

AUTUMN TRIMESTER FINAL EXAMINATION - (2021/2022)

School of Computer Science

COMP3013J Object-Oriented Design

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Time Allowed: 120 minutes

Instructions for Candidates:

Answer **All** Questions.

BJUT Student ID:__________________ **UCD Student ID:**__________________

I have read and clearly understand the Examination Rules of both Beijing University of Technology and University College Dublin. I am aware of the Punishment for Violating the Rules of Beijing University of Technology and/or University College Dublin. I hereby promise to abide by the relevant rules and regulations by not giving or receiving any help during the exam. If caught violating the rules, I accept the punishment thereof.

Honesty Pledge:____ **(Signature)**

Instructions for Invigilators

Non-programmable calculators are permitted.

No rough-work paper is to be provided for candidates.

Question 1: Short Questions

a. Describe the top-down and bottom-up strategies for implementation. List an advantage for each strategy. **(5%)**

b. Explain the meaning of the term *hotspot* in reference to application frameworks. Describe an example of a hotspot class and where it might be used. **(5%)**

c. Explain the 'Law of Demeter' as it applies to Object-Oriented Programming (use an example). How can the principle of this law be stated simply? **(5%)**

d. Explain in general terms what situation requires a statechart to be developed for a class. What exactly does a statechart tell us about the object it represents? **(5%)**

e. Explain what is meant by object identity. Describe how object identity is implemented in most object-oriented programming languages. Describe the strategy we learned for representing object identity in persistent storage. Explain the difference between the two implementations. **(5%)**

f. Explain the 'Liskov substitution principle' in your own words. **(5%)**

g. What is cohesion? Should our classes always be as cohesive as possible? Why is this the case (give an example)? **(5%)**

h. What is typically shown on a deployment diagram? In what situations can this type of diagram be useful? **(5%)**

(Question Total 40%)

Question 2: Methodology

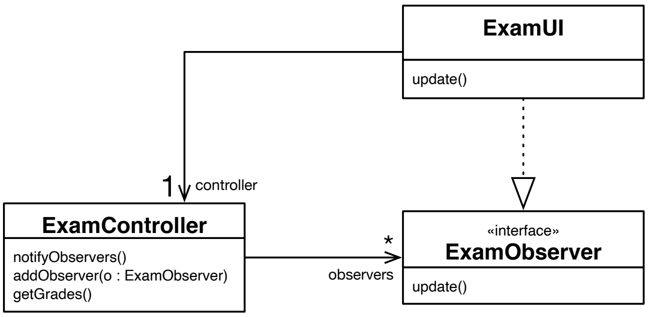
a. Discuss how evolutionary models and the spiral model influenced more modern process like the Unified Process. **(10%)**

b. When using modelling in an iterative process it can be difficult to maintain consistency between models and code. What causes this difficulty? Compare and contrast two possible solutions to this problem. **(10%)**

(Question Total 20%)

Question 3: Patterns

a. Consider the following class diagram.



Draw a sequence diagram to show the interactions that take place after a grade has been changed and needs to be updated on the UI. You can assume that the `getGrades` method returns all of the required information and does not require any other methods to be called.

(10%)

b. Explain the idea behind the Singleton pattern. Give example code showing how the singleton pattern is implemented. **(10%)**

(Question Total 20%)

Question 4: Modelling

a. Draw a UML class that shows the classes that could be used to represent the following facts about a payment and billing system for a shop.

- Items can be purchased in the shop and every item has a name, description and price
- Customers of the shop have their name and address remembered
- An order (made by a specific customer) records the date and time of a purchase as well as the items purchased and the quantity (how many) of each item
- The total cost of the items (before tax) can be calculated as well as the amount of tax and the price after tax
- Orders can be paid in multiple installments and can be of different types:
  - If a payment is made by credit card, the card number and expiry date must be recorded (and the amount of the payment)
  - If a payment is made by cash, the amount of the payment must be recorded as well as the amount of cash paid and the change given to the customer
- Orders can calculate if they have been paid in full or not

The diagram should include **attributes** (including types), **operations**, **associations**, **multiplicities**, **visibilities** and **role names** where appropriate. **(20%)**

(Question Total 20%)

(Exam Total 100%)