

NANYANG TECHNOLOGICAL UNIVERSITY**SEMESTER 1 EXAMINATION 2022-2023****SC2006/CE2006/CZ2006 – SOFTWARE ENGINEERING**

Nov/Dec 2022

Time Allowed: 2 hours

INSTRUCTIONS

1. This paper contains 4 questions and comprises 4 pages.
 2. Answer **ALL** questions.
 3. This is an open-book examination.
 4. All questions carry equal marks.
 5. Refer to Appendix A on page 4 for the project description which is needed to answer some of the questions.
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1. Based on the project description given in Appendix A,
 - (a) Identify the actors and use cases of the project and draw the use case diagram. Use <<include>> and <<extend>> relationships where appropriate. (17 marks)
 - (b) Write the use case description for the functionality of holding a car. Your use case description must include the following elements: Actors, Pre-conditions, Flow of events and Alternative flows, if any. (8 marks)
 2. (a) From your use case description in Q1(b), identify the main classes and their associations and draw a conceptual class diagram. Your conceptual class diagram should clearly depict the stereotypes of each class (i.e., Boundary, Control, or Entity) and associations between them. You do not need to identify any attribute or operation within the classes. (8 marks)

Note: Question No. 2 continues on Page 2

- (b) Draw a dialog map diagram that shows the states and transitions of the component of car holding. (8 marks)
- (c) Waterfall process model is not a good choice when requirements often change. Can customer involvement solve the problem? Justify your answer. (4 marks)
- (d) Using the Scrum method in project development, explain how to estimate the progress of project so that the team can finish the project on time. (5 marks)
3. (a) Refer to the classes identified in your answer to Q2(a):
- (i) Propose an appropriate architecture for the system X, and draw a detailed Class diagram with key attributes and methods in each class to reflect the architecture design. (8 marks)
 - (ii) Propose an alternative architecture design using a different design pattern and discuss the advantages of the alternative architecture. (6 marks)
- (b) Answer the following questions related to software design:
- (i) Propose a scenario in the system X where more than one design patterns can be applied, and draw the class diagram to explain the scenario. (8 marks)
 - (ii) Explain when two design patterns can be combined or merged, and give an example. (3 marks)
4. (a) When a car is registered via the system X, the following information is required in the registration page:

Note: Question No. 4 continues on Page 3

1. Car Model: the car model information, which must be in ASCII format.
2. Color: one of “White”, “Black”, “Blue”, “Red” and “Others”.
3. Manufacturing Date: a date between 2010 and 2022.
4. Price, which is a 6-digit integer value.
- (i) Determine the equivalence classes for the above FOUR inputs. (4 marks)
- (ii) Determine the boundaries of the equivalence classes identified in your answers to Q4(a)(i). For each boundary, identify a value on the boundary, a value just below the boundary, and a value just above the boundary. (4 marks)
- (iii) You intend to perform **defensive testing** of the vehicle information input interface. Design a set of test cases to test the FOUR inputs based on the equivalence classes and boundary values identified in your answers to Q4(a)(i) and Q4(a)(ii). (5 marks)
- (b) Answer the following questions related to software testing and maintenance:
- (i) Write at least two differences between Unit Testing and System Testing. (4 marks)
- (ii) Grey Box Testing is a software testing technique to test a software product or application with partial knowledge of internal structure of the application. The purpose of grey box testing is to search and identify the defects due to improper code structure or improper use of applications. Explain why Grey Box Testing can potentially be a better testing method than white box testing and black box testing. (6 marks)
- (iii) Explain when there is a need to perform a software refactoring. (2 marks)

Appendix A

System X is a car selling system. The system allows users to browse or search new cars and used cars currently available with the dealer. If a user is interested in buying a car and wants to hold the car for a period for consideration, the user must create an account in the system and login to the system. Only one user is allowed to hold a car at any moment. During the holding period, other users will not be able to purchase the car or hold the car. To hold a car, the user must pay a deposit in a payment system of the dealer. If the holding expires or the user cancels the hold, the deposit will be returned to the user. If a user decides to buy a car, the user needs to complete the purchase together with a staff of the dealer. The car must not be held by another user.

The staff of a dealer can access the system after login as a staff. The system allows a staff to see all the information of a car, such as whether it is held by a user, whether it is sold, whether it is available, as well as the price, promotions, etc. The system allows a staff to create, update and delete orders for users. The system allows a staff to complete the car delivery after the full payment confirmation is received from the payment system of the dealer.

Besides the above functions of the system for staff, a sale manage of the dealer is able to add, update and delete information of new cars and used cars for sell and generate reports of sales for a specific period.

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.