

NANYANG TECHNOLOGICAL UNIVERSITY**SEMESTER 2 EXAMINATION 2022-2023****SC2006/CE2006/CZ2006 – SOFTWARE ENGINEERING**

Apr/May 2023

Time Allowed: 2 hours

INSTRUCTIONS

1. This paper contains 4 questions and comprises 5 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 5 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 item replacement. 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. (7 marks)

Note: Question No. 2 continues on Page 2

- (b) Draw an activity diagram that shows the activities of the process of item replacement with the involved participants: user, chatbot and existing web-based system. (8 marks)
- (c) One disadvantage with the integration and configuration software process model is that requirement compromises may need to be made. Describe why this disadvantage exists and how you would reduce the impact of this disadvantage. (4 marks)
- (d) You are a Scrum Master with a development team that is new to the Scrum method in the middle of a sprint. During a daily stand-up meeting, one of the developers states that they have identified a bug in the code that may impact the team's ability to complete one of the features in the sprint backlog by the end of the sprint. The development team is unsure how to proceed and is seeking your guidance. Keeping in mind the Scrum methodology, how would you handle this issue? Justify your answer. (6 marks)
3. (a) Refer to the classes identified in your answer to Q2(a):
- (i) Propose an appropriate architecture for the Chatbot system 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 Chatbot system where more than one design patterns can be applied and draw the class diagram to explain the scenario. (8 marks)

Note: Question No. 3 continues on Page 3

- (ii) Propose a possible method to evaluate an architecture design or compare two architecture designs. (Hint: thinking about the structural information of the software architectures) (3 marks)
4. (a) When an order is placed via the Chatbot system, the following information is required:
1. Product ID: the product identity information, which must be in ASCII format.
 2. Quantity: a 7-digit integer value.
 3. Payment Date: a date between 2010 and 2023.
 4. Shipping method: one of “Flat rate”, “Express”, “Next-day Delivery”, “Pickup” and “Others”.
- (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 order information. 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) ChatGPT is an artificial intelligence chatbot developed by OpenAI and launched in 2022. It is built on top of OpenAI’s GPT-3 family of large language models. Although the core function of a chatbot is to mimic a human conversationalist, ChatGPT is versatile. For example, it can write and debug computer programs, compose music, teleplays, fairy tales, and student essays, write poetry and song lyrics. Answer the following questions related to software testing and maintenance:
- (i) ChatGPT is able to understand the software requirement descriptions. How can we use this capability to help to perform software testing? (3 marks)

Note: Question No. 4 continues on Page 4

- (ii) ChatGPT is able to understand the software by summarizing the behavior of a given code. How can we use this capability to perform software testing?
(3 marks)
- (iii) Based on the information above, suggest two possible ways to use ChatGPT for software maintainability tasks.
(6 marks)

Appendix A

Chatbot System for Costumer Services Description

A company wants to develop a chatbot for its website to assist customers in shopping. While a customer can search for product-related information and place an order on the website, the chatbot can assist customers in resolving their queries and helping them place orders through text-based conversations. For example, a customer could initiate a conversation with the chatbot by typing a question about a product. The chatbot can then use natural language processing technology to understand the query and respond appropriately, pulling relevant information from the database as needed.

The chatbot must be able to interact with users via text-based communication. It is able to provide product information, pricing, and availability when being asked. For shopping, customers must log in first. The chatbot shall guide customer to add specific items to their shopping carts; to place orders and confirm their payment methods and deliveries; to provide order status updates; as well as to process replacement and refund requests.

Items purchased are eligible for free replacement/refund within 7 days of delivery. Should a customer want to get a free replacement/refund, the customer must provide pictures of the item, receipt of purchase and reasons for replacement/refund. Based on the company's confirmation, the replacement/refund procedures will be sent to the customer, otherwise, the rejection will be sent to the customer. The chatbot must be able to guide the customer to submit his/her replacement/refund request.

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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.