NANYANG TECHNOLOGICAL UNIVERSITY

SEMESTER 2 EXAMINATION 2021-2022

CE2006/CZ2006 – SOFTWARE ENGINEERING

Apr/May 2022 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 uses cases of the project and draw the use case diagram. Use <<include>> and <<extend>> relationships where appropriate.

   (10 marks)

   (b) Write the use case description for the functionality of user login. Your use case description must include the following elements: Actors, Flow of events and Alternative flows, if any.

   (7 marks)

   (c) Draw a state machine diagram that shows the states and transitions of the login functionality.

   (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)

(b) If you are going to develop the project,

i. Which process model are you going to take: Waterfall model or Agile model? Justify your selection.

(3 marks)

ii. What are the advantages and disadvantages of the two models (i.e. Waterfall model and Agile model) respectively?

(6 marks)

(c) Give a summary of Extreme Programming method and Scrum method respectively and explain the differences of the two methods.

(8 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 the observer pattern can be applied, and draw the class diagram to explain the scenario.

(6 marks)

Note: Question No. 3 continues on Page 3

(ii) Propose a scenario where you can extend the observer pattern above with one more design pattern learned in the course, and draw the class diagram to explain the scenario.

(5 marks)

4. (a) When a user registers in the system X, the following information is required in the registration page:

1. Name: the user name, which must be in ASCII format.
2. Race: one of "Chinese", "Malay", "Indian", and "Others".
3. Date of Birth: a date between 1900 and 2010.
4. Body Mass Index (BMI), which is a 2-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 user registration 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) Give two different software development tasks excluding basis path testing, where Cyclomatic Complexity can be used. [*Hint: what can CC values imply?*]

(4 marks)

Note: Question No. 4 continues on Page 4

(ii) Data flow testing is a family of test strategies based on selecting paths through the program's control flow in order to explore sequences of events related to the status of variables or data objects. Dataflow Testing focuses on the points at which variables receive values and the points at which these values are used. Based on this explanation, try to explain the difference between data flow testing and control flow testing.

(4 marks)

(iii) Propose two different information, which can be potentially used to estimate the efforts of maintaining a software.

(4 marks)

Appendix A

A system X is built to help users to change their diet behaviors. The system allows users to take photos of food using a camera on a smartphone. Then these photos will be uploaded to a server automatically. A report of tagged as healthy or unhealthy food will be sent to individual's account with appropriate comments about their diet. Users can choose to use a free version to get comments for three photos or pay a monthly fee to get comments for all uploaded photos.

Each user must register using their email address and setup a password. They can choose to use a free version of the system or pay a monthly fee for professional version. The free versioned users can only get comments for three photos every month. The professional versioned users do not have limitations to get comments on photos. Later, users are required to login to the system to use the system. The processing of advance version fee is handled by an external accounting system, Y.

For user login,

- The use provides the email address and password to the system to verify the user's account.
- If the email address or password is incorrect, an error message 'Invalid Email or Password' is shown to the user.
- If the email and password are correct, the system connects to the Y system to check the professional version fee status.
- If the user has paid for the professional version for this month, the user will be directed to the home page of the system. Otherwise, a message 'Would you like to purchase the professional version' will be shown to the user. If the user chooses 'yes', the user will be directed to payment page. If the user chooses 'skip', the user will be directed to the home page of the system.

After a user signs in,

- The user is able to upload photos to server part of the system.
- The system can tag photos as healthy, unhealthy, or unrelated food accordingly. If the photo is tagged unrelated, the system administrator can change the tag manually.
- The system will send the user a report with the tags of the food and related comments for diet recommendation.

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.