NANYANG TECHNOLOGICAL UNIVERSITY

SEMESTER 1 EXAMINATION 2017-2018

CE2006/CZ2006 – SOFTWARE ENGINEERING

Nov/Dec 2017 Time Allowed: 2 hours

INSTRUCTIONS

1. This paper contains 4 questions and comprises 6 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 6 for the project description which is needed to answer all 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.

   (10 marks)

   (b) Write the use case description for the functionality of computing the *funds availability for a couple*. Your use case description must include description of the user case, flow of events and any alternative flow if it exists.

   (10 marks)

   (c) Design a dialog map to represent the functionality of adjusting the value of the bank expenses.

   (5 marks)

2. (a) From your use case diagram in Q1(a) and use case description in Q1(b), identify the main classes and their associations. Draw a class diagram that depicts the classes and associations between them. You do not need to identify any attribute or operation within the classes.

(9 marks)

(b) From your use case description in Q1(b), design a sequence diagram to represent the functionality of computing the *funds availability for a couple*.

(13 marks)

(c) Identify your role in the course project team and use your own words to briefly describe the responsibilities of that role.

(3 marks)

3. (a) Refer to the classes identified in your answer to Q2(a).

(i) Propose an appropriate architecture for the XYZ system.

(1 mark)

(ii) Justify your architecture proposed in Q3(a)(i) by listing THREE (3) benefits of the proposed architecture. State ONE (1) drawback of your proposed choice of architecture.

(4 marks)

(iii) With the aid of an architecture diagram from your proposed architecture in Q3(a)(i), indicate the analysis classes, i.e. boundary classes, control classes, and entity classes on your proposed architecture in Q3(a)(i). State clearly the dependencies between classes on the architecture diagram.

(4 marks)

(iv) Use ONE to TWO sentences to explain briefly the core responsibility of each analysis class in the architecture you proposed in Q3(a)(iii).

(3 marks)

Note: Question No. 3 continues on Page 3

(b) Currently, borrowers from XYZ Bank return their borrowed money via three payment methods: NETs, Visa, or MasterCard. Payment methods can be expanded in the future to accommodate borrowers' needs and new payment methods, such as online payment (i.e. Paypal) and mobile payment.

(i) Identify and explain briefly TWO (2) design problems to implement the payment methods requirement.

(3 marks)

(ii) Propose an appropriate design pattern to address the design problems identified in your answer in Q3(b)(i).

(2 marks)

(iii) Depict the application of the design pattern proposed in Q3(b)(ii) in a class diagram. Explain briefly the roles each class plays in the proposed design pattern.

(8 marks)

4. (a) The XYZ Bank supports a couple to buy a home under the following two approval conditions:
C1: The couple must be currently employed full time.
C2: The couple current combined annual total income must not be more than $100,000. Specifically, the couple combined annual total income must be between $0 and $99,999. The income must be an integer value.

(i) Determine the equivalence classes for the above two approval conditions.

(3 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 local access option. Design a set of test cases to test the two above approval conditions based on the equivalence classes and boundary values identified in your answers to Q4(a)(i) and Q4(a)(ii).

(5 marks)

Note: Question No. 4 continues on Page 4

(b) The XYZ system displays a borrower menu when users select "Manage borrowers" option from the main menu. The borrower menu offers the user the choice of adding, modifying, or deleting a borrower. The *displayBorrowerMenu()* method (as shown in the Java code snippets in Figure Q4(b)) implements this interface.

(i) Draw the control flow graph for the *displayBorrowerMenu()* method. [*Use the line numbers for clarity*]

(5 marks)

(ii) Calculate the Cyclomatic Complexity of the *displayBorrowerMenu()* method.

(2 marks)

(iii) List the basis set of linearly independent paths for performing basic path testing of the *displayBorrowerMenu()* method. Design a test case (including the input parameters to the *displayBorrowerMenu()* method and expected outcome) for each of the basic paths.

(6 marks)

Note: Question No. 4 continues on Page 5

```
/**
  displayBorrowerMenu() displays a borrower menu, offering the user the choice of
  adding, modifying, or deleting a borrower; the appropriate method is then called.
  The user may also choose to return to main menu.
*/
1   public static void displayBorrowerMenu () {
2       char choice;                                  // user's choice
3       boolean done = false;                         // terminates while-loop
4       Borrower borrower = new Borrower ();   // borrower record
5       while (!done) {
6           clearScreen ();
7           System.out.println ("\t          BORROWERS \n\n");
8           System.out.println ("\t       1. Add a borrower \n");
9           System.out.println ("\t       2. Modify a borrower \n");
10          System.out.println ("\t       3. Delete a borrower \n");
11          System.out.println ("\t       4. Exit to main menu\n");
12          System.out.println ("Enter your choice and press <ENTER>: ");
13          choice = getChar();
14          switch (choice) {
15              case '1':
16              borrower.add ();
17              break;
18              case '2':
19              AssetManager.manageBorrower ();
20              break;
21              case '3':
22              borrower.delete ();
23              break;
24              case '4':
25              done = true;
26              break;
27              default:
28              System.out.println ("\n\nNot a valid choice\n");
29              pressEnter();
30              break;
31          } // switch
32      } // while
33      return;
34  } // displayBorrowerMenu ()
```

Figure Q4(b)

Note: Appendix A is on Page 6

Appendix A

The XYZ System Description

XYZ bank provides low cost financial support for young couples to buy new home. The bank is planning to have a software system (named XYZ system) for bank staff to determine how much money will be available to lend to a young couple (i.e. *funds availability for a couple*).

Project description

The XYZ bank determines *funds availability for a couple* based on the *bank income*, the *bank expenses*, and the amount of money returned by the borrowers.

In details, the XYZ system

- shall compute the *fund availability for a couple* for the bank staff as follows:
    - Compute the *bank income* the bank earned so far.
    - Compute the *bank expenses*.
    - Compute the amount of money returned by the borrowers.
    - Compute the *fund availability for a couple* using the above three factors.
    - Determine the money availability to the couple:
        - If the money requested by the couple is lower or equal to the *fund availability for a couple*, the bank will lend the money requested to the couple; otherwise, the bank will lend the *fund availability for a couple* to the couple.
- shall manage borrowers. It allows the bank staff to perform the following operations: add a new borrower, modify existing borrower information, and delete an existing borrower.
- shall manage incomes. It allows the bank staff to perform the following operations: add a new income, modify an existing income, and delete an existing income.
- shall manage expenses. It allows the bank staff to perform the following operation: adjust (i.e. update) the value of expenses.
- shall produce reports upon request. The borrower report will list all the borrowers and their account balances while the income report will list all the bank incomes.

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.