CITY UNIVERSITY OF HONG KONG

Course code & title : CS3342 Software Design

Session : Semester A 2006/07

Time allowed : Two hours

This paper has FOUR pages (including this cover page).

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1. This paper consists of FOUR questions.
2. Answer ALL questions.
3. You should give your answer in the context of the case study, if any.
4. You may use pencils to present your specifications or designs.
5. For your own benefit, you are strongly advised to make your specifications or designs meaningful to the examiner, showing the working steps as you see fit.
6. If you need to make any (reasonable) assumptions on the questions, please state them in your answers.

Question 1. (12 marks)

For each question, write "T" or "True" in the answer book if it is true; otherwise, write "F" or "False".

1(a) In a good software development project, everyone should know all details about the project.

1(b) The spiral model is more preferable than the waterfall model to develop a software with high technical risk.

1(c) Is the following is a functional requirement: "When the user inputs the street address of a location, the system should show a map that contains the location and the location should be put at the center of the map."

1(d) Software engineers should always use interviews to collect requirements from users.

1(e) Suppose that there are three use cases: "Pay an invoice", "perform payment transaction" and "validate transaction". Their relationships are: "Paying an invoice must involve performing payment transactions. Performing payment transactions must involve the validation of the correctness of the transaction."

In the use case modeling, is the relation between "Pay an invoice" and "perform payment transaction" an <<extend>> relation?

1(f) A use case specification describes at lease the sequences of actions (by actors) and reactions (by the system).

1(g) A system sequence diagram is a type of sequence diagram.

1(h) In an object-oriented analysis phase, we often model an important domain concept as a class.

1(i) In an object-oriented analysis phase, we should always use many-to-many relationship to make the proposed system as general as possible.

1(j) In an object-oriented design phase, we should specify how the proposed system supports each important use case by defining how objects communicates amongst themselves, and then update the design class diagram accordingly.

1(k) When the test case is (a = 9, b =3), the test case cannot fulfill the statement coverage for the following program:

```
if (a >= 0 && a <= 9)
      sum = list1[a];
if (b >= 0 && b <= 9)
      sum = sum + list2[b];
```

1(l) A test case documentation should at least define the test case and the expected test result.

Question 2. (28 marks) [Requirement Capturing]

SIGN-ON is a fashionable item boutique at Festival Rock. Fashionable items are "out" (i.e., outdated) quickly and hence, the company would like to have a software application to process the mail purchase of their items.

> When a customer sends us (i.e., purchase officers) a purchase order, we firstly browse the order. We will check whether we have stocks for the purchased items. When we have stocks, we assign the goods to the order. In addition, we will re-order the goods from the suppliers if the re-ordering level is reached. If the Accounting Department informs us that the payment of the order is O.K., we mail the receipt to the customer. If the payment is not O.K. or we have no stock, we cancel the order and issue an order cancellation notification to the customer.

The company has some additional requirements or concerns about the new system:

- The system should do the above re-ordering of goods from suppliers automatically.
- The system should issue the receipts and order cancellation notification to the customer automatically.
- The system should process the purchase order using the Internet Technology.
- Many purchase officers are very poor in using computers.
- The system should be available before next February.

2(a) Identify the primary actor(s) and secondary actor(s) of the above Process Order use case. **[4 marks]**

2(b) Write a use case specification for the above Process Order use case. You should show at least the Purpose, Actor, Precondition, Flow of events, alternate flow of event (if any) and postcondition. **[12 marks]**

2(c) Suppose that you want to evaluate the feasibility to implement the system. What aspects will you consider in a feasibility study? **[4 marks]** Illustrate your points using the above Process Order scenario. **[8 marks]**

Question 3 (48 marks) [Object-Oriented Analysis and Design]

On Wing Travel (OWT) is a leading travel agency in Hong Kong. Its tour escorts currently use their little paperbacked notepads to record special arrangements of individual tour members. The trouble is that they occasionally confuse a member with another, resulting in embarrassing arrangements. OWT proposes to improve the situation by using smart Personal Digital Assistants (PDAs) and smart badges.

The user requirements are as follows:

- An existing and external system (called System *OWT*) should let the tour escorts to enroll customers to their tours.
- The PDA of the tour escort will automatically download the details of the members and the summary of members' badge allocation from System *OWT*.
- The tour escort will distribute a badge to every member, and enable the PDA to recognize the badge.
- The signal from a badge will trigger the member profiler of the PDA to display the details of the badge holder. The tour escort hence verifies the specific arrangements as raised by the member accordingly.

- [Update Member Profile] From time to time, members make new tour requests or require a replacement badge during the tour. A tour escort will use the Tour Escort Organizer (TEO) of the PDA to make necessary changes to the arrangements kept in the member profiler. Firstly, the tour escort has to activate the TEO sign-on manager, provides username and password, and then presses the "*sign-on*" button. A successful sign-on should bring the tour escort to the main page of the TEO to make changes. The tour escort can then issue the replacement badge to the members. A failed sign-on will transfer the screen to the help page. Also, "*double clicking*" on the "*sign-on*" button will also bring the tour escort to the help page.
- [Member Nearby] The tour escort may press the "*Around?*" button. The PDA will detect those members nearby. Based on the badge and member databases, the PDA shows the list of detected members, and highlights, on another list, who are not detected.

3(a) Propose a use case diagram for the new system. Note that there is no need to show the associated use case specifications. **[10 marks]**

3(b) Draw a (logical) user interface to support the "Member Nearby" requirement. **[5 marks]** Elaborate how your user interface fulfills the requirement. **[4 marks]**

3(c) Apply object-oriented analysis to the case study to produce a domain model. (There is no need to identify the attributes for the conceptual classes)

- Finding the potential objects and selecting the proposed objects. **[7 marks]**
- Drawing conceptual classes in class diagram and identifying the relationships amongst conceptual classes. **[7 marks]**

3(d) Specify one sequence diagram for the badge replacement scenario described in the requirements. **[10 marks]**

3(e) Please elaborate why you design your solution as shown in your answer of Question 3(d). **[5 marks]**

Question 4. (12 marks) [Software Testing]

Consider the following program `foo`:

```
s0:   int a, b;
s1:   read(a, b);
s2:   while (a != b) {
s3:       if (a > b)
s4:           a = a - b;
s5:       else b = b - a;
s6:   }
s7:   write("done");
s8:   exit(0);
```

4(a) Propose two test cases such that each of them CANNOT fulfill the statement coverage for program `foo`. The two test cases should not cover the same set of statements. **[2 marks]**

4(b) Consider the condition "`(a > b)`" at statement `s3`. Propose a set of test cases that can fulfill the decision coverage for the condition. **[3 marks]**

4(c) Consider the condition "(a != b)" at statement `s2`. If you apply Boundary Value Analysis on the condition, what are the test cases that you will construct to test the condition? **[3 marks]**

4(d) What is the procedure to conduct software testing? **[4 marks]**

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