



**THE UNIVERSITY OF THE WEST INDIES**

**EXAMINATION OF April 2007**

Code and Name of Course: Paper: CS22Q – Introduction to Software Engineering

Date and Time: April 27<sup>th</sup> 2007, 9:00am – 11:00am

Duration: 2 hrs

INSTRUCTIONS TO CANDIDATES: This paper has 5 pages and 5 questions.

**ANSWER QUESTION 1 AND ANY 2 (TWO) OTHER QUESTIONS**

**QUESTION 1**

In the analysis of a system for monitoring a zoo, you have taken on the task of documenting their current registration and care procedures for animals. You have determined that new animals need to be tagged by zoo attendants. The zoo attendants will determine which animals to tag by reading a list distributed by the zoo coordinator, who creates that list based on the results of a physical survey of incoming inventory from its suppliers.

The zoo coordinator will also periodically check animals' records to determine if an animal is due a medical checkup, and prepare a checkup list for the zoo attendants and veterinarian to process. During the check to determine if a medical checkup is due, it is standard for a physical checkup to be done. If during a physical checkup, it is discovered that an animal has a medical emergency, an urgent appointment is made for the animal with the veterinarian, at which zoo attendants need to be present. If the animal cannot be cured, then the animal will need to be discharged from the zoo.

The zoo coordinator reports his inventory in a quarterly meeting to the Ministry of Agriculture, comparing his inventory with inventories in other zoos.

Animals need to be available for taggings, physical surveys and discharges.

- a. i. List the actors in the scenario described above. (2 marks)
- ii. Identify the use cases in the scenario described above. (4 marks)
- iii. State the use cases which are related, and state whether the relationship is an "includes" or "extends" relationship. (3 marks)
- iii. Draw a use case diagram showing how actors and use cases interact. (3 marks)

*(Question 1 continued on next page)*

*(Question 1 Cont'd)*

- b. Name the three generic types of viewpoints which are important for requirements analysis purposes, giving an example of each viewpoint from the scenario described above. (3 marks)
- c. State one expected user goal of the system, and indicate how system requirements may be influenced by that goal. (2 marks)
- d. Explain why the use of natural language as a requirements documentation method is not normally appropriate, and briefly explain an appropriate method for the scenario. (2 marks)
- e. You have realized that the animal handlers who know the details of the tagging process, take so much of the process for granted that they are not able to do a good job describing process details. State an elicitation method that would perform very well at filling in missing information. (1 mark)

## QUESTION 2

- a. With the aid of a diagram, describe the waterfall software development model. (5 marks)
- b. Explain the concept of "grow vs build" when applied to Rapid Application Development. (2 marks)
- c. While speed of development is a clear advantage of Rapid Application Development processes, there are distinct challenges. Briefly discuss two of these challenges. (2 marks)
- d. Discuss whether time or flexibility constraints are important in deciding whether fine grain re-use or large grain re-use is to be applied. (3 marks)
- e. State one risk associated with depending on off the shelf components for a software development process. (1 mark)
- f. Briefly explain two challenges involved in certifying components to be used for software development. (2 marks)

## QUESTION 3

- a. In the creation of a test plan, one required section is an identification of the items which will be tested. Briefly describe two other sections. (2 marks)
- b. In the development of a system to control the delivery of insulin to diabetics, you have designed a module that takes as input the blood sugar level of a patient, the weight, and the time of day in determining the required insulin dose.

You have simplified the process of calculating the dosage based on the following logic:

If all the following three conditions are true- ie

- a. Weight  $\leq$  200 pounds,
- b. Time of day after 6 pm but before 6 am, and
- c. Blood sugar level is above expected minimum,

then the dosage delivered will be one unit.

If any of the conditions are false, the dosage is to be doubled, for each false condition.

*(Question 3 continued on next page)*

(Question 3 Cont'd)

It has been decided that an active test is required for each possible set of inputs to the program, and that a tabular test plan is needed to record the results of the test.

- i. State the number of test cases which can capture all possible results for the insulin dosage calculation module. (1 mark)
  - ii. Construct a tabular test plan to record the results of this test. (5 marks)
- c. i. State one issue which can be detected with active testing, but cannot be detected with static testing. (1 mark)
- ii. State two issues which can be detected with static testing, but cannot be detected with active testing. (2 marks)
- d. Give the term describing the re-testing of previously working components after an enhancement has been implemented. (1 mark)
- e. To improve testing efficiency, automated testing may be used at times. Explain the function of **oracles** if automated testing is used. (1 mark)
- f. State two possible sources of these **oracles**. (2 marks)

#### QUESTION 4

In a systems development process, the tasks in the table below have been identified, with the corresponding successors.

Task ID	Task name	Successors	Duration(days)
A	Requirements Elicitation	B	5
B	Logical Design	C	3
C	Physical Design	D,G	8
D	Implementation	H	20
E	Market Research	F	15
F	Market Penetration	K	30
G	Test Plan Preparation	H	5
H	Unit Testing	I	10
I	Integration Testing	J	5
J	User Acceptance Testing	K	10
K	Deployment		5

- a. Develop the network diagram for the task list. (5 marks)

(Question 4 continued on next page)

*(Question 4 Cont'd)*

- b. On the network diagram, determine the critical path by calculating the forward pass and the backward pass (showing the early start and early finish, as well as the late start and late finish for each task).

*(5 marks)*

- c. In a project in which the planned value (budget) is \$2,000,000, the actual cost is \$500,000 and the earned value is \$1,000,000, what is the estimate at completion, if all variances have been typical?

*(For typical variances,  $ETC = (BAC - EV) / CPI$ ;  $CPI = EV / AC$ )* *(2 marks)*

- d. Indicate one risk for which an estimate such as the one calculated in section C, could be a trigger.

*(1 mark)*

- e. Explain why low grade is not necessarily a problem, but low quality always is. *(2marks)*

## **QUESTION 5**

It has been decided that to improve the safety of surgical procedures at St. Jacob's Hospital, a system which monitors the power requirements of surgical theatres in the event of general power outages will be implemented. The objective of the system is to capture information on the progress of operations, and to give feedback on the level of reserve power available. If the reserve power available is not enough to support all theatres in use at full power, a strategy to reduce power to the minimum required for each theatre will be implemented. A local controlling computer will be installed in each theatre to manage its requirements, in communication with a monitoring server.

- a. Discuss the type of system control which would be ideal in this distributed system, paying attention to safety requirements and the need to quickly respond to changing situations. *(4 marks)*

*(Question 5 continued on next page)*

(Question 5 Cont'd)

Figure 1 below depicts a possible flow diagram which can be used to implement the method by which the monitoring server can keep current information on progress in operating theatres (assuming happy cases where everything goes as planned).

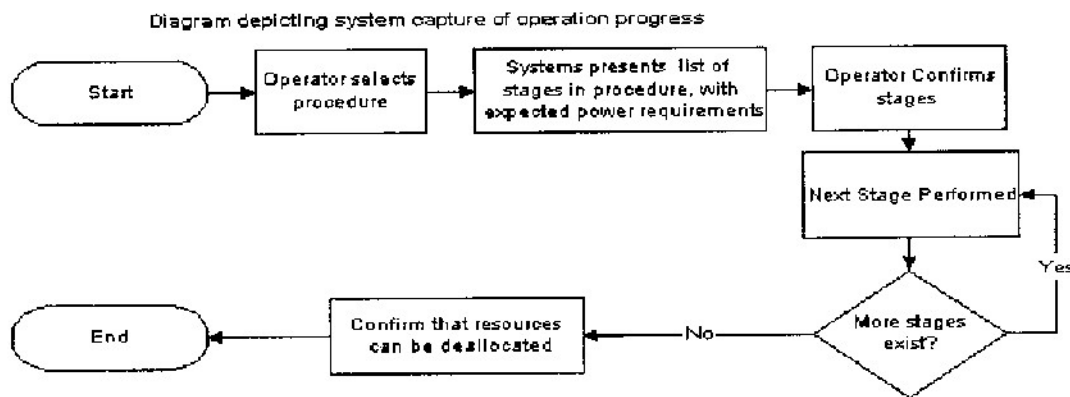


Figure 1

- b. List the screens which would be useful in implementing this process flow. (3 marks)
- c. State one category of user interface for the screens that could be recommended for this section of system, and two categories that should be avoided. (2 marks)
- d. In specifying the physical design, one section is the specification of the inputs and outputs. State four other sections, explaining their importance. (4 marks)
- e. Indicate the importance of alternatives while presenting the logical design. (1 mark)
- f. Explain why it is important, early in the physical design stage, to identify the architecture to be applied. (1 mark)

