



THE UNIVERSITY OF THE WEST INDIES

EXAMINATION OF December 2007

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

Date and Time: Monday, December 10, 2007 1:00pm – 3:00pm Duration: 2 hrs

INSTRUCTIONS TO CANDIDATES: This paper has 6 pages and 5 questions.

ANSWER QUESTION 1 AND ANY 2 (TWO) OTHER QUESTIONS

QUESTION 1[20 marks]

- Explain what is meant by the term “Emergent System Property” in the context of software engineering. (1 mark)
- Indicate one example of how an emergent system property may affect a business critical system in a negative manner, and how the impact of the property may be mitigated. (1 mark)
- Figure 1 represents a model of a commonly applied software engineering process.

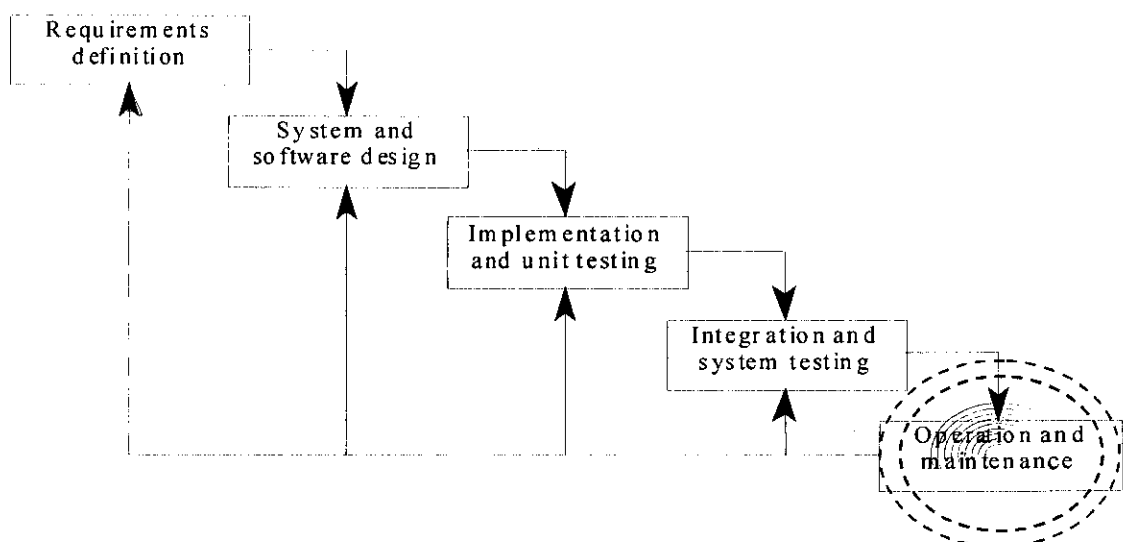


Figure 1.

- Name the process model. (1 mark)
- Briefly explain the expected outputs of each step in the process model. (5 marks)

(Question 1 Cont'd)

(Question 1 Cont'd)

d. Figure 2 describes another set of software engineering process models.

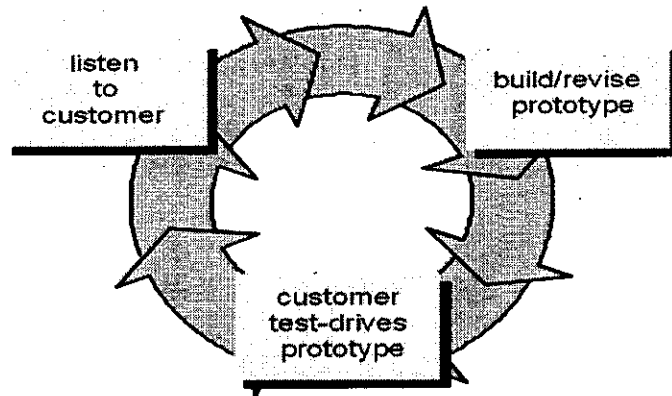


Figure 2

- i. Give a term used to describe this category of process models. (1 mark)
 - ii. Discuss how schedules and deliverables obtained using these process models are likely to differ from those of the process model depicted in part c. (2 marks)
- e. You are operating a software development firm that currently has two systems planned for delivery in the near future. System A involves implementing a module of a GIS based security monitoring system to be hosted primarily at the Jamaica Defence Force Air Wing, for which the final date for installation has been set to one year before the next General Elections are constitutionally due. System B is internal to your firm, and involves the implementation of an online shopping and delivery architecture.
- For **EACH** system, describe TWO (2) possible benefits, as well as ONE (1) challenge, to be expected
- i. When using the development process model described in part c. (4 marks)
 - ii. When using the development process model described in part d. (4 marks)
- f. Name two different prototyping practices that are commonly used in software engineering, which differ based on the expected end result of the prototype. (1 mark)

QUESTION 2. [15 marks]

- Describe three different types of contracting that are commonly applied in the context of project management, explaining the expectations of contractor and client for each. **(3 marks)**
- While managing quality, explain how an inspection process is different from a prevention process. **(1 mark)**
- Explain why low grade is not necessarily a problem, but low quality always is. **(1 mark)**
- For the project network diagram shown in figure 3, use critical path analysis to generate the list of tasks on the critical path. **(7 marks)**

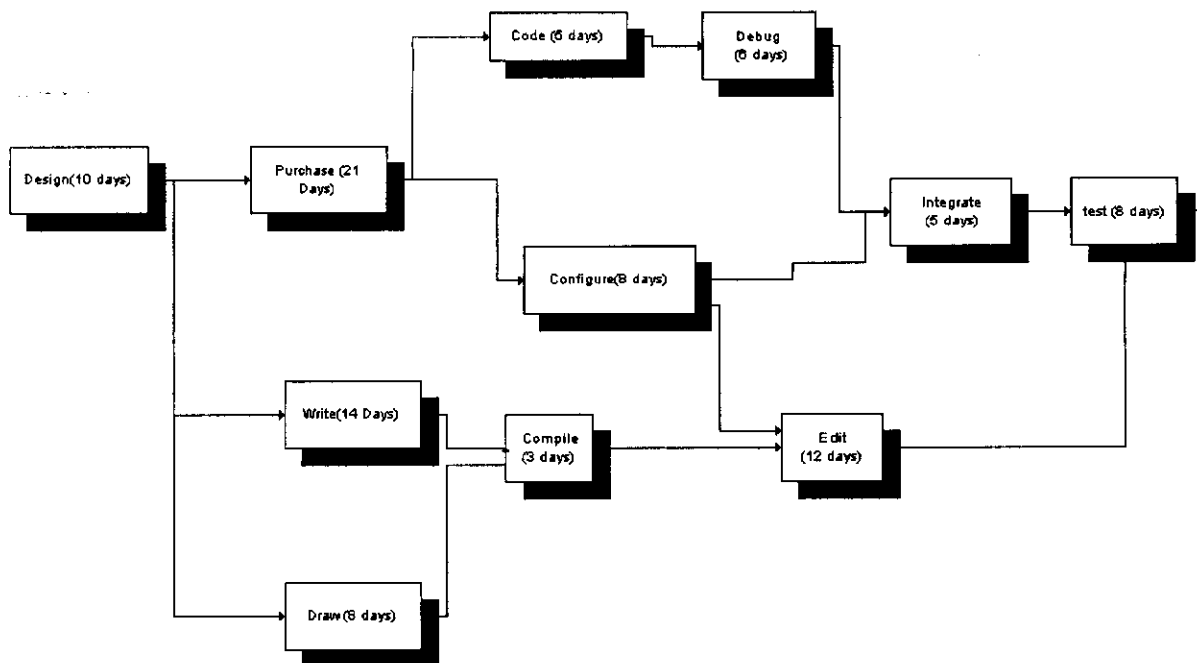


Figure 3

- A budget of \$600,000 has been allocated to the completion of objectives, with a fairly constant work rate (such that halfway through the project it is expected that \$300,000 would be expended). At the halfway point however, two things have happened which had pushed your actual expenditure to \$450,000. First, salary re-negotiations which have resulted in increased consultant rates, have resulted in you paying \$100,000 more to consultants. Second, a new government has put a licensing process in place to start the project resulting in your payment of a \$50,000 fee. You plan to discuss with the bank options to bridge this project until the next one begins immediately after. If you will use only the bank's money to bridge the project, how much money do you need from the bank to complete financing of the project? *(Show working)* **(3 marks)**

QUESTION 3. [15 marks]

a. In the creation of a test plan, one required section is an identification of the items which will be tested.

Briefly describe one other section.

(1 marks)

b. Your firm has been contracted to create a modeling tool which is to accept various inputs, and output a number indicating the amount of carbon dioxide added to the atmosphere from vehicles daily. A background to the project is a plan to introduce ethanol enabled vehicles. Research has shown that use of ethanol can result in less greenhouse gas emissions. The ethanol enabling process will allow conventional (regular) vehicles to use either gas or ethanol as fuel. Government and business leaders, however, need to know the critical mass of ethanol production which may have a chance of reducing greenhouse emissions to acceptable levels, and turn a profit.

In the simplified model you are working with, you will consider the fuel consumption, percentage of vehicles that are ethanol enabled, and the price difference between gas and ethanol. Based on these three inputs, your output will be an index, which, when multiplied by the fuel consumption, gives the expected number of greenhouse gas units added to the environment daily.

The logic therefore which you wish to implement in your algorithm is:

If all the following three conditions are true- ie

- a. Fuel consumption \leq 1 million gallons per day,
- b. Percentage of ethanol enabled vehicles \geq 35%, and
- c. Ethanol is cheaper than gas,

then the index will be one unit.

If any of the conditions are false, the index is tripled, for each false condition.

- i. State the number of test cases which can capture all possible results for the index calculation module. *(1 mark)*
- ii. Construct a tabular test plan to record the results of this test. *(5 marks)*
- c. State one issue which can be detected with **active** testing, but **not** with static testing. *(1 mark)*
- d. Give the term describing the re-testing of previously working components after an enhancement has been implemented. *(1 mark)*
- e. Briefly explain, with the aid of a diagram, the V model of Software development, which shows that test planning does not have to wait on the system to be developed. *(6 marks)*

QUESTION 4. [15 marks]

The government of Jamaica has procured a loan, the proceeds of which are to support the installation of a city-wide camera/Audio Monitoring system. The system will include a central monitoring system and numerous remote monitoring devices, each of which has been equipped with both a wired and a (hidden) wireless mode. When wired, the device will send information and receive commands through communication wires, and receive power from its environment. If the device becomes disconnected from the wired network, the wireless mode activates, which triggers a GPS beacon along with a few other sensors, and has the ability to initiate communication as long as its battery has power. In the wireless mode, the device will wake up, and go to sleep intermittently, to preserve battery life and reduce the possibility of detection by unfriendly elements. Creating an appropriate communications infrastructure for the system is a challenge.

- a.* With your knowledge of subsystem architecture design, suggest a protocol for communications (which can include a combination of basic architectures depending on operating mode) to ensure the central monitoring station gets timely information from remote subsystems. **(5 marks)**

To make sure the resulting system is used efficiently, a good design needs to be agreed between the potential users, and you, the contractor.

- b.* State, giving an example from the system described, the components which will make up both your logical and physical design for the monitoring application. **(6 marks)**
- c.* Ready-made components should be considered to reduce development time. Briefly discuss two properties that you would expect to be in place before you consider using a component. **(2 marks)**
- d.* State two risks to which the process may be exposed if using ready-made components. **(2 marks)**

QUESTION 5. [15 marks]

- a. State the four stages involved in the requirements elicitation process. **(4 marks)**
- b. It is believed that proper monitoring of road traffic conditions, and accordingly adjusting the timing of traffic lights can ease the congestion on the roads at peak hours. To this end, the Ministry of Transport and Works has initiated a traffic optimization project, and has assigned you the job of investigating how this could be done.
- i. Name the three generic viewpoints from which requirements can be elicited, giving an example of each that would be applicable to the traffic optimization project. **(3 marks)**
 - ii. You realize it is possible to acquire a device called a roadFreer, which, when attached to a traffic light, can detect the current type of traffic flow, and adjust the timings accordingly. Through communication with other roadFreers attached to traffic lights, you believe it is possible to have a system where traffic flows more easily out of heavy traffic zones. One of the responsibilities of each roadFreer is to determine a type of traffic flow, and transmit the traffic flow information to adjacent roadFreers. Determining the type of traffic flow involves counting vehicles passing when the light is green. In the event there is a standstill (ie. the number of vehicles passing when the light is green equals 0), the Traffic Department should be contacted.

In addition to determining traffic flow, the roadFreer also needs to

1. set the traffic light timings, as well as
2. receive traffic information from the location on the left, and
3. receive information from the location on the right.

On receiving information from either device, the roadFreer needs to save the received information.

Draw a use case diagram depicting the operation of a roadFreer. **(8 marks)**