



UNIVERSITY OF COLOMBO, SRI LANKA

UNIVERSITY OF COLOMBO SCHOOL OF COMPUTING

DEGREE OF BACHELOR OF INFORMATION TECHNOLOGY (EXTERNAL)

Academic Year 2009/2010 – 2nd Year Examination – Semester 3

IT3203 Software Engineering 1

PART 2 – Structured Question Paper

20th March, 2010

(ONE HOUR)

To be completed by the candidate

BIT Examination Index No:

Important Instructions:

- The duration of the paper is **1 (One) hour**.
- The medium of instruction and questions is English.
- This paper has **3 questions** and **13 pages**.
- **Answer any 2 of the questions (50 marks each) only.**
- **All questions carry equal marks**
- **Write your answers** in English using the space provided **in this question paper**.
- Do not tear off any part of this answer book.
- Under no circumstances may this book, used or unused, be removed from the Examination Hall by a candidate.
- Note that questions appear on both sides of the paper.
If a page is not printed, please inform the supervisor immediately.

Questions Answered

Indicate by a cross (X), (e.g.

X

) the numbers of the questions answered.

To be completed by the candidate by marking a cross (X).	1	2	3	
To be completed by the examiners:				

- 1) (a) Boehm divides software quality attributes into two broad categories, namely, current usefulness and potential usefulness. Explain these two categories.

(04 marks)

ANSWER IN THIS BOX**Current Usefulness –**

The qualities expected from a software system in user's point of view

Potential Usefulness –

The qualities expected from a software system in developer's point of view

- (b) Explain the following attributes and decide to which category (i.e. current usefulness or potential usefulness) each attribute belongs.

(16 marks)

ANSWER IN THIS BOX

	Explanation	Category
Modularity	The software is designed and implemented (or divided) into separately named and addressable components (modules) which are integrated to satisfy problem requirements.	Potential usefulness
Reliability	The frequency and criticality of software failure, where failure is an unacceptable effect or behavior occurring under permissible operating conditions.	Current usefulness
Portability	The ease with which software can be used on computer configurations other than its current one.	Potential usefulness
Usability	The software is applicable to the situation and has the correct functions. It is usable and has supporting documentation.	Current usefulness

- (c) Software maintenance is the costliest operation in the software development process. Identify four reasons which require changes in software.

(04 marks)

ANSWER IN THIS BOX

Any 4 from the following:

- Errors in the existing system
- Changes in requirements
- Technological advances
- Legislation and other changes
- The change in the business environment

- (d) What is a Software Process? Why is it important?

(06 marks)

ANSWER IN THIS BOX

A Software Process is a set of ordered tasks involving activities, constraints and resources which produce a software system

OR

A Software Process is the set of activities and associated results which produce a software product. eg. Specification, Design, Validation & Verification, Evolution

OR

A process is important because it imposes consistency and structure on a set of activities, It guides our actions by allowing us to examine, understand, control and improve the activities which comprise the process

- (e) Give three examples of software process models which use Incremental Software development methods.

(06 marks)

ANSWER IN THIS BOX

Any 3 from the following:

- Evolutionary Prototyping
- Incremental Development
- (Bohem's) Spiral Model
- Rational Unified Process
- Extreme Programming
- Rapid Application Development (RAD)

- (f) Explain what is meant by Requirement Validation. Explain the importance of requirement validation.

(06 marks)

ANSWER IN THIS BOX

Requirement validation is concerned with showing that the requirements actually define the system which the customer wants.

OR

Requirement Validation is checking the correctness of the specification of requirements. In this activity, checks should be carried out to make sure that the requirements are accurate and complete.

OR

The importance of requirements validation: (Any one from the following)

- Problems arise when requirements are not precisely stated.
- Ambiguous requirements may be interpreted in different ways by developers and users.
- Errors in a requirements document can lead to extensive rework costs when they are subsequently discovered during development or after the system is in service.

(The cost of fixing a requirements problem by making a system change is much greater than repairing design or coding errors, because a change to the requirements usually means that the system design and implementation must also be changed and then the system must be tested again)

- (g) Briefly explain the following types of tests.

(08 marks)

ANSWER IN THIS BOX

	Explanation
Recovery Testing	Force the system to crash and then try to recover to a sensible state.
Security Testing	Attempt to access the system without the correct authority, or attempt to carry out restricted functions.
Stress Testing	Attempt to break the system by overloading it.
Performance Testing	Ensure the system meets the performance requirements.

- 2) (a) What are the four main sectors in Boehm's spiral model of the software process?

(06 marks)

ANSWER IN THIS BOX

- Objective Setting (Determine objectives/goals, alternates and constraints)
- Risk assessment and reduction (Evaluate alternatives, identify, resolve risks)
- Development and validation (Develop, verify next-level product)
- Planning (Plan next phase)

- (b) Give three examples of approaches which use agile methods for software development.

(03 marks)

ANSWER IN THIS BOX

Any three from the following:

- Extreme Programming
- Scrum
- Crystal
- Adaptive Software Development
- Feature Driven Development
- Agile modeling and agile instantiations of the Rational Unified Process

- (c) List down five practices which are used in Extreme Programming.

(05 marks)

ANSWER IN THIS BOX

Any five from the following:

- Incremental planning (Story cards are used to determine development tasks)
- Simple design
- Test-first development
- Refactoring
- Pair programming
- Collective ownership
- Continuous integration
- Sustainable pace
- On-site customer

(d) Give three problems associated with the Rapid Application Development (RAD) model.

(06 marks)

ANSWER IN THIS BOX

Any three from the following:

- RAD requires sufficient human resources to create the right number of RAD teams.
- RAD requires developers and customers who are committed to the rapid-fire activities necessary to get a system completed in a much abbreviated time frame.
- If a system cannot be properly modularized, building the components necessary for RAD will be problematic.
- RAD is not applicable when technical risks are high. This occurs when a new application makes heavy use of new technology or when the new software requires a high degree of interoperability with existing computer programs.

(e) In the software design stage, the following notions are important.

Abstraction, Modularity, Information Hiding, Cohesion and Coupling.

(10 marks)

ANSWER IN THIS BOX

	Definition
Abstraction	This is an intellectual tool (a psychological notion) which permits one to concentrate on a problem at some level of generalization without regard to irrelevant low level details
Modularity	The division of software into separately named, addressable components called modules.
Information Hiding	Specifying and designing modules so that information (procedure and data) contained within a module is directly inaccessible to other modules.

Cohesion	Interaction within a module. A measure of how well a component fits together
Coupling	A measure of the strength of the interconnections between system components.

(f) Consider the following program segment.

```

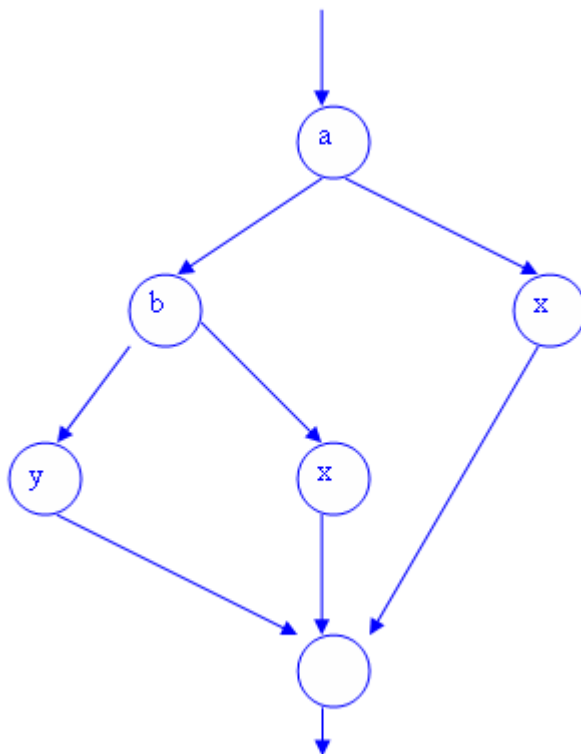
If a or b Then
    Procedure x
Else
    Procedure y
End if

```

(i) Draw the control graph for the following program segment.

(06 marks)

ANSWER IN THIS BOX



(ii) Calculate the Cyclomatic Complexity (CC) for the above program segment.

(02 marks)

ANSWER IN THIS BOX

$$CC = \text{No. of Edges} - \text{No. of Nodes} + 2$$

$$= 7 - 6 + 2$$

$$= 3$$

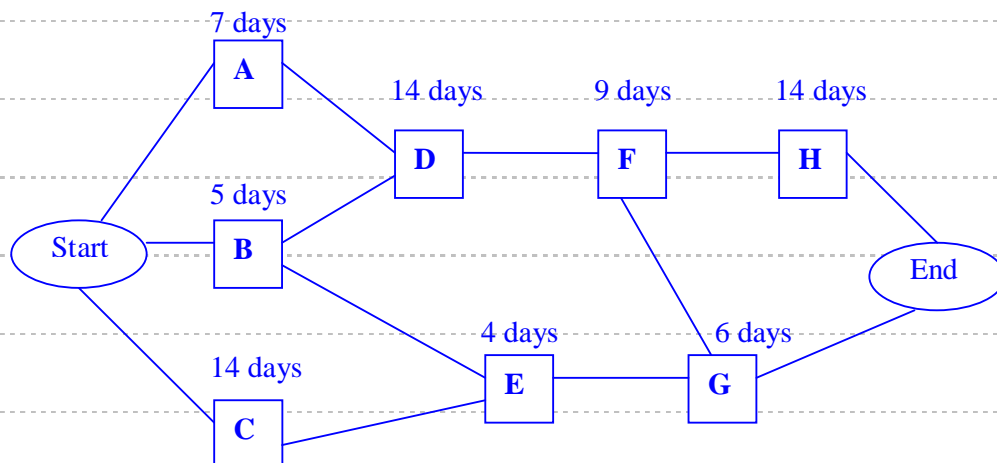
(g) The following data relates to the first phase of a software project

Task	Duration (Days)	Depends on
A. Establish functional requirements	7	-
B. Establish non-functional requirements	5	-
C. Implement prototype	14	-
D. Implement core program	14	A, B
E. Implement network components	4	B, C
F. Implement non-core components	9	D
G. Implement interfaces	6	E, F
H. Unit Test	14	F

(i) Use the given data to create an activity network.

(10 marks)

ANSWER IN THIS BOX



(ii) Identify the critical path. What is the duration of the critical path?

(02 marks)

ANSWER IN THIS BOX

Start → A → D → F → H → End

Critical path consists of 44 days

3) (a) Discuss why eliciting and understanding requirements are difficult?

(08 marks)

ANSWER IN THIS BOX

Any four from the following:

- Stakeholders often do not know what they want from a computer system except in most general form.
- Stakeholders express requirements in their own terms and requirement engineers, without experience in customer domain, must understand these requirements.
- Different stakeholders may have conflicting requirements.
- Political factors may influence the requirements of the system.
- New requirements may emerge and requirements may change during the analysis process.

- (b) Suggest 3 possible stakeholders of a university student record system. Explain the possibility of arising conflicting requirements among those suggested stakeholders using an example.

(07 marks)

ANSWER IN THIS BOX

- **Lecturers, Administration staff, Students, Finance staff, Accounting staff**
- **Requirements may conflict as different stakeholders need different formats of student records.**

○ Example:

- Accounting and Finance Staff may not need student examination results while Administration staff needs it.
- Lecturers may not need student personal information while Administration staff needs it.

- (c) “Feasibility study is a short, focused study that aims to answer a number of questions”. List down three such questions which are addressed by feasibility study.

(03 marks)

ANSWER IN THIS BOX

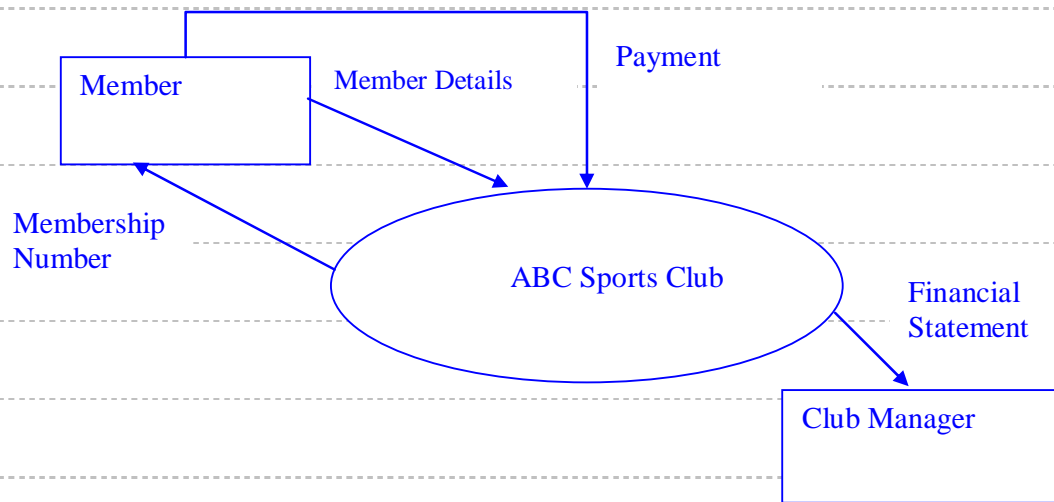
- Does the system contribute to the overall objectives of the organization?
- Can the system be implemented using current technology and within given cost and schedule constraints?
- Can the system be integrated with other systems which are already in place?

(d) Draw a context level Data Flow Diagram for the following scenario about ABC Sports Club.

“Membership of ABC Sports Club can be obtained by completing a membership form. The completeness of the membership form will be checked by the clerk and is then recorded in a membership file. Afterwards, payment from the member is accepted and then recorded in the general ledger file. After receiving the payment, a membership card will be issued to the member. At the end of each month, a financial statement is prepared based on the general ledger file and sent to the club manager.”

(08 marks)

ANSWER IN THIS BOX



- (e) Briefly describe following 3 widely used organization styles.
- Repository Model
 - Client-Server Model
 - Layered Model

(12 marks)

ANSWER IN THIS BOX***a) Repository Model:***

Sub-systems making up a system must exchange information so that they can work together effectively. There are two fundamental ways in which this can be done.

- All shared data is held in a central database that can be accessed by all-subsystems.
- Each sub-system maintains its own database. Data is interchanged with other sub-systems by passing messages to them.

b) Client-Server Model:

This is a system model where the system is organized as a set of services and associated servers and clients which access and use the services. There are 3 major components of this model.

- A set of servers which offer services to other sub-systems.
- A set of clients which call on the services offered by the servers.
- A network that allows the clients to access these services.

c) The layered model

In this model the system is organized into layers, each of which provides a set of services. Each layer can be thought of as an abstract machine whose machine language is defined by the services provided by the layer. This model supports incremental development of systems and also is changeable and portable. An example of this model is the OSI reference model of network protocols.

- (f) Giving reasons for your answer, suggest an appropriate architectural model for the following systems
- An automated ticket issuing system used by passengers at a railway station.
 - A robot floor cleaner which is intended to clean relatively clear spaces such as corridors. The cleaner must be able to sense walls and other obstructions.

(08 marks)

ANSWER IN THIS BOX

a) **A centralized model with a shared repository.**

The system needs a shared database with information about trains, routes and prices, so that, changes can be immediately made available to all the machines.

b) **Repository model where all the sub-systems place information in the repository for other sub-systems to use.**

Here, the repository data is not well structured. Hence, each sub-system (eg: obstacle sensors, path planning) is required to place information in the repository for decision making. This is called 'blackboard' model.

- (g) What is the main difference between a fat-client and a thin-client approach to client-server systems development?

(04 marks)

ANSWER IN THIS BOX

In thin-client model, all of the application processing and data management is carried out on the server whereas in fat-client model, the server is only responsible for data management.
