

98-Comp-A6
Software Engineering

3 Hours Duration

Notes:

1. If doubt exists as to the interpretation of a question, the candidate is urged to submit with the answer paper a clear statement of any assumptions made.
2. No calculators permitted. This is a closed book exam.
3. Answer any five of the eight questions.
4. Any five questions constitute a complete paper. Only the first five questions as they appear in your answer book will be marked.
5. All questions have equal weight.

Marking Scheme

1. (a) 15 marks; (b) 5 marks.
2. (a) 5 marks; (b) 15 marks.
3. 20 marks.
4. (a) 5 marks; (b) 5 marks; (c) 10 marks.
5. (a) 6 marks; (b) 6 marks; (c) 8 marks.
6. (a) 5 marks; (b) 15 marks.
7. (a) 10 marks; (b) 10marks.
8. (a) 6 marks; (b) 6 marks; (c) 8 marks.

Total mark out of 100.

Question 1. *The Software Development Process.*

- (a) List the stages of the software development life cycle and briefly describe each stage.
- (b) Contrast and compare these stages to the stages of purchasing and owning a piece of equipment, such as a car or a refrigerator. In particular, contrast the life cycle costs of owning the equipment with that of software. How are they similar and how are they different? Justify your answer.

Question 2. *Software Design and Function-Oriented Design.*

- (a) Discuss the differences between object-oriented and function-oriented design.
- (b) A software system is to be developed for a microprocessor-based *Home Security System* (HSS). The system receives input from entry sensors, smoke sensors, temperature sensors and flood sensors. The system is capable of generating alarms, turning on selected lights, and calling owner-specified phone numbers. The system is owner-programmable through a keypad. The owner can set thresholds for the sensors, program phone numbers and set delays for various alarms.

Using a function-oriented approach, derive a design for the HSS described above. Make reasonable assumption and clearly state them.

Question 3. *Object-Oriented Design.*

Using an object-oriented approach, derive a high-level design for the system outlined below. Make reasonable assumptions about the system and state them clearly.

An automatic date-book system for keeping track of daily appointments electronically.

Question 4. *Software Testing.*

- (a) Explain why testing can only detect the presence of errors, not their absence.
- (b) Some believe that developers should not be involved in testing their own code but that all testing should be the responsibility of a separate team. Give arguments for and against testing by the developers themselves.
- (c) Derive a set of tests for a method called 'cutWhiteSpace' in a 'Paragraph' object that, within the paragraph, replaces sequences of blank characters with a single blank character.

Question 5. *Embedded Software.*

- (a) Define real-time software systems. What is the difference between soft real time systems and hard real time systems?
- (b) Identify possible stimuli and the expected responses for an embedded system that controls a home refrigerator.
- (c) Use a state-based approach to model the operation of an embedded software system for a voice mail system commonly included in a landline phone. The system should display the number of recorded messages on an LED display and should allow the user to dial in and listen to the recorded messages. Make reasonable assumptions and state them clearly.

Question 6. *Requirements Specification.*

- (a) Discuss briefly the problems of using natural language for requirements specification.
- (b) Discover ambiguities or omissions in the following statement of requirements for part of a ticket issuing system.

A ticket issuing system is intended to automate the sale of rail tickets. Users select their destination, and input a credit card and a personal identification number. The rail ticket is issued and the credit card account is charged with its cost. When the user presses the start button, a menu display of potential destinations is activated along with a message to the user to select a destination. Once a destination has been selected, users are requested to input their credit card. Its validity is checked and the user is then requested to input a personal identifier. When the credit card has been validated, the ticket is issued.

Question 7. *Software Reuse.*

- (a) In an object-oriented programming language, *information-hiding* and *inheritance* can be used to adapt software components for reuse. Describe information-hiding and inheritance, and their role in supporting code reuse.
- (b) Using an *object-oriented* approach, design reusable interfaces for the following abstract data types:
 - A stack.
 - A character string.

Question 8. *Software Quality.*

- (a) What is software quality management?
- (b) List the three main activities of software management for large systems.
- (c) Explain why it is difficult to validate the relationship between internal product attributes, such as program size or number of procedure parameters, and external attributes, such as maintainability.