



# UNIVERSITY *of* LIMERICK

O L L S C O I L L U I M N I G H

COLLEGE *of* INFORMATICS *and* ELECTRONICS

Department of Computer Science  
and Information Systems

## **End-of-Semester Assessment Paper**

|                   |                  |                         |        |
|-------------------|------------------|-------------------------|--------|
| Academic Year:    | 2006/2007        | Semester:               | Autumn |
| Module Title:     | Software Quality | Module Code:            | CS4157 |
| Duration of Exam: | 2 ½ hours        | Percent of Total Marks: | 80     |
| Lecturer(s):      | Michael T. Lane  | Paper marked out of:    | 80     |

### **Instructions to Candidates:**

- 7 Questions. Please answer any 4 questions
- Each question is 20 marks. Note that sub-parts of questions carry different marks.

A friend who has set up a company to create a software product has grown to depend upon your advice in relation to various aspects of software quality. They have asked you to discuss certain issues that have been brought to their attention by their new employees.

Q1. In relation to software testing they have heard that it is a very good idea to conduct software qualification testing. However, they are not entirely sure what the term software qualification means and what class of testing would be used to address this issue.

a) Describe the term software qualification and what aspects of software quality this process may address. Outline the class of tests that should be used to qualify software.

4 Marks

b) Explain to your friend the concepts of software errors, faults and failures. Discuss the concept of code coverage by contrasting different coverage types such as line, statement, branch and path coverage. Explain how achievement of complete path coverage may be an impractical goal.

6 Marks

c) Following on from your explanation on the difficulties surrounding path coverage, describe McCabe's cyclomatic complexity metrics to your friend. Keep your description at a high level. It should be an overview of the goals of the complexity metric, what is actually measured and how the complexity measurement may influence your test planning. Conclude with a high-level view on what certain measurements may mean to the complexity of a piece of software.

5 Marks

d) To illustrate McCabe's cyclomatic complexity metric further, you decide to go through an example with your friend. To simplify matters, you have already performed the first step of the process by building a sample flow chart from the code under review. Appendix A contains the sample flow chart. You are now requested to convert this to a flow graph and then describe and use all three formulae suggested by McCabe. Note that all three formulae should result in the same complexity measurement!

5 Marks

Q 2. Your friend wishes to have some mechanism for determining the quality of the software produced by the company. You suggest that the application of a number of quality factors to the software requirements could help the development team determine what attributes are deemed most important for the product and subsequent reviews and tests could focus on whether the selected quality attributes are being addressed.

Describe in detail McCall's quality factors model, showing different categories of factors and explaining what aspects of the software are addressed by each factor. In your explanation of each factor, briefly describe what class of test you would use to test the software for the required quality.

20 Marks

Q 3. Your friend is developing a software package that will be sold to the public as an “off-the-shelf” product. They are delighted with this “in-house” development approach as it means that they have not had to deal with contract negotiations.

- a) It is likely that their customer is their firm’s marketing department and this loose relationship between the in-house departments could contain some pitfalls. Describe these pitfalls and suggest a possible approach that may help to avoid them.

5 Marks

- b) Explain to your friend that certain planning should be conducted prior to beginning the development project. Describe in detail the plans that should be put in place. Provide a brief overview of the various elements that constitute these plans.

15 Marks

Q 4. a) Appendix B outlines a scenario related to a requirement for a pricing module of the proposed software package. Using this scenario, describe to your friend the concept of “equivalence class partitioning”. Support your description with 5 valid test cases built using this approach and 2 invalid test cases. Be sure to include in your description the concepts of valid and invalid equivalence classes.

10 Marks

- b) Your friend is keen to do “lots of automated testing”. They are not sure why but they have been told that it’s the “way to go!” Describe the different types of automated tests and various advantages that may be gained from conducting certain automated testing. However, ensure that your friend is fully aware of the different phases of the testing process regardless of whether testing is manual or automated and explain to them the additional costs that they will incur when they require tests to be automated.

10 Marks

Q5. An active software system is a system in constant change. In preparation for this prospect, your friend has been warned to invest in the purchase and adoption of a good configuration management system. You are required to provide an overview of such systems. You must describe their purpose, concepts such as software configuration items and versions, and the various tasks involved with software configuration management.

20 Marks

Q 6. Although, the product is still to be developed, your friend has been told that the maintenance phase may constitute a much larger part of the overall software product lifecycle. They are concerned about ensuring that this phase is successful and ask your assistance.

- a) Give a brief description of the different types of maintenance that the product may be faced with.

5 Marks

- b) Explain that one of the two foundations of high-quality maintenance is the quality of the underlying developed product. Describe the different aspects of the development that should be addressed in order to ensure high quality maintenance. List the form of maintenance impacted by each quality attribute addressed and the reason why the particular attribute influences that form of maintenance.

7 Marks

- c) Name the particular policy that is identified as the second foundation of high-quality maintenance. Describe the main elements considered in this policy. Describe how the different elements or aspects of this policy can be applied. In your description, explain to your friend why certain applications of these different elements or policies may be more preferable over other possible applications

8 Marks

Q 7. a) Your friend wishes to introduce elements of measurements to the workplace in order to understand and control productivity. However, they have limited knowledge of software metrics and have asked for your assistance. Begin by providing a description of metrics and how they may be used.

4 Marks

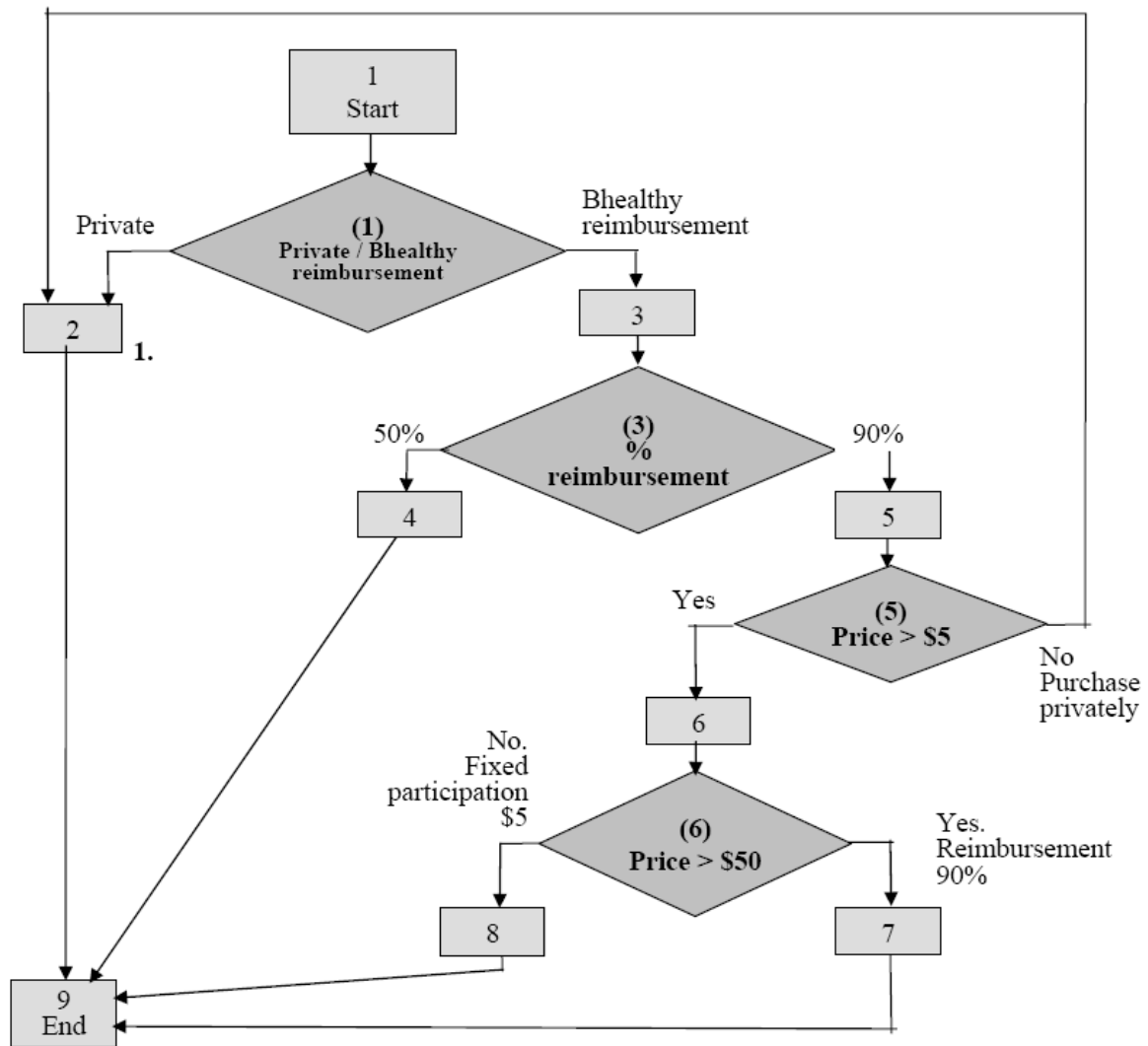
- b) Process metrics is a classification sometimes used to describe measurements of activities conducted during the development process. Provide an overview of the different types of metrics that fall within this group. Choose two specific metrics as examples to illustrate this subject to your friend. Detail the formulae used to calculate your chosen metrics and describe to your friend how they could apply these metrics to their development process. Explain how the chosen metrics could be used to control and improve product development.

9 Marks

- c) Your friend is trying to determine how best to estimate the amount of effort required to do various development projects. Up-front estimation is required but feedback from the development team is very vague. Describe the function point method of pre-project estimation. Your description should be a high level overview of the different stages of this method. Explain why this method is more suited to your friend's needs than the KLOC measurement for software size.

7 Marks

## APPENDIX A



## APPENDIX B

A ticket pricing system for a tour bus is based upon certain criteria:

Passenger status: Student or regular

Duration of tour: One-day (S) tour or multiple days(M)

Tour departure day: Weekdays are different cost to weekends.

Tour departure time: 9:00 – 12:00; 12:01 –19:00;

| Departure Day    | Mon, Tue, Wed, Thu, Fri |         |         |         | Sat, Sun |         |         |         |
|------------------|-------------------------|---------|---------|---------|----------|---------|---------|---------|
| Passenger Status | Student                 | Regular | Student | Regular | Student  | Regular | Student | Regular |
| Tour Duration    | S                       | S       | M       | M       | S        | S       | M       | M       |
| Ticket Prices    |                         |         |         |         |          |         |         |         |
| Departure Time   |                         |         |         |         |          |         |         |         |
| 9:00 – 12:00     | 3                       | 5       | 4       | 6       | 5        | 8       | 8       | 10      |
| 12:01 –19:00     | 2                       | 4       | 3       | 5       | 4        | 7       | 7       | 9       |