UNIVERSITY OF LIMERICK

COLLEGE OF INFORMATICS AND ELECTRONICS

Department of Computer Science
and Information Systems

End-of-Semester Assessment Paper

Academic Year:	**2005/06**	Semester:	**Semester 1**
Module Title:	**Software Quality**	Module Code:	**CS4157**
Duration of Exam:	**2 $\frac{1}{2}$ Hours**	Percent of Total Marks:	**80**
Lecturer:	**Michael T. Lane and Michael English**	Paper marked out of:	**100**

Instructions to Candidates:

- Use separate answer book for each section. Each section carries equal marks.
- Section A:
  - Question 1 is mandatory - 20 marks
  - Answer two of the remaining 3 questions out of section A (Q2, Q3 or Q4). Each question carries 15 marks
- Section B: Answer any 2 of the 3 questions in this section. Each question carries 25 marks
- Note that the examiner can take into account the quality of presentation and exposition as well as the content.
- Calculators are not allowed.

SECTION A
Note - Question 1 is compulsory.
Please answer 2 of the remaining 3 questions from section A

Q1

(a) Explain the tasks of software configuration management. 4 Marks

(b) Explain the difference between baseline and intermediate software configuration versions 4 Marks

(c) The maintenance policy is identified as a foundation of high-quality maintenance.

(1) List the main policies considered in a maintenance policy.

(2) Describe how these policies can be applied, giving reasons why a particular application of a policy may be more preferable to other possible applications. 4 Marks

(d) According to IEEE and ISO, software is made up of four main components.

(1) List these four components of software.

(2) How does the quality of each component contribute to the quality of the developed software? 8 Marks

Q2

McCall's factor model classifies all software <???> into 11 software quality factors. These factors are grouped into three categories.

(a) In the above statement what does <???> stand for? i.e. what set of documents would you review using the factors specified by McCall.

(b) What are the three factor categories belonging to McCall's factor model?

(c) For each category, list and describe 2 factors included in it. 15 marks

Q3

(a) List the four types of review methods discussed in this module. Give a brief description of each review type, listing at least one objective of each type of review. (Note, different reviews may have the same objective !!). 8 Marks

(b) List the 7 phases in the SDLC (Software Develoment Life Cycle Model or Waterfall model) and give a very brief description of each phase. 7 Marks

Q4

(a) List the 5 objectives of Development and quality plans. 5 Marks

(b) For three of the objectives listed in Q4(a) above, suggest ways in which each objective contributes to the successful and timely completion of the project. 3 Marks

(c) Identify and describe the elements of a quality plan 5 Marks

(d) List the different levels of the Capability Maturity Model and provide a 1 to 2 line description of each level. 2 Marks

SECTION B

Answer any 2 Questions. All questions carry equal marks

Q5

(a) Software Testing can be considered a destructive process. Why? 3 marks

(b) Briefly explain the testing techniques Equivalence Partitioning and Boundary Value Analysis. 6 marks

(c) How does the procedure for determining test cases for valid and invalid equivalence partitions differ? 4 marks

(d) Consider the following specification for the price of a cinema ticket: The ticket price depends on three variables: day(weekday, weekend), ticket type(child, adult, family), film start time(14.00-18.00, 18.01-23.30).

Given this specification do the following:

- Construct a table illustrating the valid and invalid equivalence classes for each variable. For each variable that represents a range illustrate the boundary values that should be checked.
- For the valid and invalid equivalence classes construct appropriate test cases to satisfy these equivalence classes. Since you have not been given the ticket price for each scenario, the column representing the expected test case result can be excluded.

12 marks

Q6

(a) Halstead's Software Science defines a number of measures of software products.

- Define Halstead's measure for the actual length of a program segment.
- Define Halstead's measure for predicting the expected length of a program segment.
- Explain the terms(i.e. variables) used in each of these measures.

9 marks

(b) Calculate the expected length and actual length of the following code segment using Halstead's measures:

```
index=1;
while (index<=N-1) {
  p=index;
  j=index+1;
  while (j<=N) {
    if (I[p]>I[j])
       p=j;
    j=j+1;
  }
  temp=I[index];
  I[index]=I[p];
  I[p]=temp;
  index++;
}
```

6 marks

(c) Construct a control-flow graph for the code segment above labelling the nodes appropriately. 4 marks

(d) How many linearly independent paths exist in the code segment above? 2 marks

(e) List all the linearly independent paths through the code segment. 4 marks

Q7

(a) "The definition of the Chidamber and Kemerer metrics: Weighted Methods per Class, (WMC), and Coupling between Object Classes, (CBO), is ambiguous". Discuss this statement. 4 marks

(b) The Chidamber and Kemerer metrics are useful as software quality indicators.

- Specify two research papers where these metrics have been validated for this purpose.

- Discuss briefly the approach taken to the validation of the metrics in these papers
- Highlight any differences you have identified between the empirical studies reported in these papers.

8 marks

(c) The Sugiyama algorithm is useful for producing aesthetically pleasing layouts of hierarchical graphs. Apply the first and second phase of the Sugiyama algorithm to the graph with nodes: $a, b, c, d, e, f, m, n, x, y, z$ and edges:
$\langle a, m\rangle, \langle x, b\rangle, \langle x, c\rangle, \langle y, b\rangle, \langle y, n\rangle, \langle z, e\rangle, \langle n, d\rangle, \langle c, f\rangle, \langle a, b\rangle, \langle a, n\rangle, \langle x, m\rangle,$
$\langle m, d\rangle, \langle b, d\rangle, \langle n, e\rangle, \langle c, e\rangle, \langle a, d\rangle, \langle b, e\rangle, \langle a, z\rangle, \langle a, c\rangle, \langle y, z\rangle, \langle y, c\rangle$
Note: In the second phase it is only necessary to apply one down-pass and one up-pass. 10 marks

(d) List 3 limitations of the Sugiyama Algorithm. 3 marks