

OLLSCOIL NA hÉIREANN
The National University of Ireland, Galway

SEMESTER II
SUMMER EXAMINATIONS 2000/2001

B.Sc. Degree Examination in Information Technology

SOFTWARE ENGINEERING III (CT417)

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Time Allowed : **Three Hours**

Candidates should attempt five questions, at least two from each section.

Please use separate answer books for each section.

All questions carry equal marks

SECTION A

1. Software Architecture

- (a) Explain the role of Software Architecture in achieving software reuse.
- (b) Explain what is meant by a Domain-Specific Software Architecture, and how it is used in practice.
- (c) Describe in detail (using diagrams and examples) the following architectural styles:
 - Interpreters
 - Layered Systems

2. **Enterprise Systems / Re-engineering**

- (a) Describe the layered services-based approach to the design of enterprise information systems. Show how the UML concepts of component views, deployment views and packages support the modelling of such systems
- (b) Describe the challenges involved in re-engineering legacy applications and the strategies which may be employed in dealing with legacy applications.

3. **Project Management / Project Planning**

- (a) Describe the typical steps in a problem resolution process (e.g. dealing with software bugs)
- (b) Describe the role of Error Tracking and Software Configuration Management tools in supporting the software maintenance process.
- (c) What is regression testing and when should it be performed?
- (d) Describe the different strategies which may be used in Configuration Management systems to multiple versions of files.

4. **Project Planning**

- (a) In the context of Risk Management, give two examples of each of the following types of risks:
 - Customer risks
 - Business risks
 - Application risks
- (b) Describe two different risk identification techniques and compare their relative merits.
- (c) Describe the support provided by project planning and scheduling tools (e.g. Microsoft Project) for the following:
 - Critical Path identification
 - Creating Work Breakdown Structure
 - Task Dependencies

SECTION B

5. (a) Write a paragraph explaining what you understand by the term *software quality*.
- (b) Write a paragraph on any two of the following terms:
- Fixed Quality Model
 - Quality Management System
 - Total Quality Management
- (c) Suppose you have overall responsibility for a number of ongoing software projects. There are wide quality variations among the projects, and you have the following measures for each project:
- Mean time to failure
 - Mean time to repair reported defects
 - Total number of user-reported failures
 - Total number of defects found during system testing
 - Total project overspend/underspend
- Discuss the relative merits of these measures for purposes of comparison across projects.
6. (a) What might cause a *loss* of quality in software? Write a paragraph describing *obstacles* to software quality.
- (b) Describe the structure of the ISO9000:2000 standard. How does this differ from the ISO9000 family of standards published in 1994?
- (c) Compare the ISO9001:2000 standard, the ISO15504 (SPICE) technical report, and the Capability Maturity Model (CMM) in terms of (i) architecture and (ii) applicability to a small software organisation.
7. (a) Describe briefly the roles of the Leader and the Recorder in a Formal Technical Review.
- (b) Since they can't usually attend reviews, suggest ways in which managers can participate in the review process.
- (c) You are a software engineer in a small/medium sized development company. Your manager, who is aware that you took a course in Software Quality, has recently asked you to help initiate a programme of Formal Technical Reviews, as part of an overall Quality Improvement programme. Until now, there has been no concept of peer reviewing in the company. Suggest some suitable first steps that you could recommend to your manager in order to successfully introduce the new programme of reviews. How would you convince your fellow engineers of the benefits of Formal Technical Reviews?

8. (a) Describe the characteristics of a typical company at level 2 in the CMM (Capability Maturity Model).
- (b) Read the following case study, and address the questions below:

UCG Software Solutions - 2 years on.

UCG Software Solutions have recently been assessed at level 2 CMM. Over the last 2 years they have grown from 30 to 45 people, and have managed to maintain their market position in the development of payroll, personnel and time and attendance systems. As a result of a successful SPI initiative, a set of processes are now in place to address the key management issues, and useful metrics have been collected on a project basis of size and cost estimates, actuals versus estimates, rate of changes to requirements, etc.

However, in a recent project, a number of problems were identified while carrying out some software engineering activities:

- A number of significant errors were introduced into the software design. However, these errors were not noticed until the system testing stage. The project incurred significant costs in fixing these errors.
- A number of bugs that were identified during system test were never fixed.
- A small change was made to one of the modules, but as a result of this change a new, more significant error was introduced.
- The software documentation produced did not reflect the original requirements.

Up to now, the project team had used Visual Basic for each project, so it was possible to base size and cost estimates on previous similar work. However, for this project new technologies were introduced and so the project manager had no historical data to use for estimation. A limited amount of information was available from another project team, but no formal mechanism was in place to share this information. In addition, some coding standards were in use by the other project team, but the project manager was unaware that these standards were available.

Identify some suitable level 3 practices that you feel would be suitable for UCG Software Solutions to address in the short term. Do these practices address any of the problems identified in the case study?