UNIVERSITY OF LONDON

IMPERIAL COLLEGE OF SCIENCE, TECHNOLOGY AND MEDICINE

EXAMINATIONS 1996

MEng Honours Degrees in Computing Part IV
MSc Degree in Foundations of Advanced Information Technology
for Internal Students of the Imperial College of Science, Technology and Medicine

This paper is also taken for the relevant examinations for the
Diploma of Membership of Imperial College
Associateship of the City and Guilds of London Institute

PAPER 4.75

SOFTWARE ENGINEERING—ENVIRONMENTS

Thursday, May 9th 1996, 10.00 - 12.00

Answer THREE questions

For admin. only: paper contains
4 questions
3 pages (excluding cover page)

1 The Outtel company released their new o586 processor. After they had produced the first batch of processors, but before they released them, it was known within Outtel that their new method of dealing with floating point division (which effected about 10 different instructions) was faulty. It relied on a look-up table and although this table had been correctly filled in the o586 simulator, the table in the actual o586 chip had a few blank places. Rather than delay the release of their much awaited processor, the decision was taken to release the chip on time with the bug. The design was also changed so that future chips would be correct. A mathematics academic found the bug when checking a straightforward calculation that produced an obviously incorrect result and made it public. Outtel immediately released free good chips and explanations which stated that the typical user would hit this bug once every 27 thousand years. Nonetheless, Outtel had a major problem on their hands which to date has cost them $400 million.

a i) Describe a sample *black box test* that would have found the bug. (You don't need to go into details.)

ii) Describe a sample *white box test* that would have found the bug. (You don't need to go into details.)

b Discuss the use of *comparison testing techniques* that should have found the bug.

c When should Outtel have completed their testing? Discuss the use of metrics collected during testing to produce a statistical model to predict the drop-off of errors.

d Why do you think that Outtel released the faulty chip?

The four parts carry, respectively, 20%, 20%, 40% and 20% of the marks.

2a Who needs to be able to evaluate tools and methods?

b To evaluate software or methods there is a large array of techniques that can be used. These include the use of formal experiments, case studies and surveys. Any of these techniques can be used to measure qualitative or quantitative properties. How do you choose which evaluation type you should use?

c What are the advantages and disadvantages of using a *case study* for evaluation purposes?

d For a software design method of your choice, briefly design a *quantitative case study*. What hypothesis are you trying to prove or disprove? What are the measurable properties?

All parts carry equal marks.

3a Many software engineering researchers argue that understanding and improving the software development process is the best way of improving the quality of software development products.

Name a process model that explicitly addresses different levels of process maturity. List these levels and for each level comment briefly on what it means for an organisation to be at that level of maturity.

b You are a software engineering consultant who is convinced of the merits of software process modelling and improvement. For each of your clients listed below, describe the kind of Process-Improvement Development Environment (PRIDE) that is most appropriate for their respective organisations. In particular, you should address:

(i) the suitability of introducing/using CASE tools,

(ii) the kind of staff that should be employed (training, contracts, etc.)

(iii) the process improvement objectives that should be aimed for.

Client 1: Transaction Processing Solutions Inc. (TPSI)

TPSI is an information systems (IS) provider which specialises in transaction processing software systems. It develops a number of such systems every year for different customers who have similar requirements but variable application domains. Technical staff find working for TPSI boring and tend to leave after 1-2 years.

Client 2: SOlutions Bring Everyone Relief (SOBER)

SOBER provide specialised technical software solutions to large engineering firms. Example systems include complex simulation software, real-time process control systems, etc. Projects typically last over 1 year, there is frequent interaction with customers, and requirements change often. The staff are highly skilled and experienced.

c Some of the most difficult software development processes to support are those which involve rapid and frequent changes to requirements. Describe one kind of technology for managing changing requirements.

The three parts carry, respectively, 30%, 60% and 10% of the marks.

Turn over ...

4a (i) What is the Model-View-Controller (MVC) approach to developing software applications? What are the advantages of deploying such an approach?

(ii) A supermarket manager uses a stock monitoring and control application written in Smalltalk using the MVC approach. Due to overwork and overuse of the computer keyboard, the manager develops repetitive strain injury (RSI) and is no longer able to use his hands to operate the application. Which part of the application would you change in order to overcome his disability? Explain why.

b For many years Borsoft Inc. have produced compilers for a variety of programming languages. As a new software engineering manager at Borsoft, you recognise that the compiler market is shrinking, but that the expertise of the staff can be adapted to develop software engineering tools that partly utilise compiler technology. You therefore agree to expand Borsoft's activities in the following three areas:

(i) The production of CASE tools to support the numerous new object-oriented methods that are commercially available, many of which are slight variations of one another.

(ii) The production of custom application programs for a few selected, well-defined and understood, problem domains.

(iii) The production of graphical user interfaces for a variety of information systems.

For each project, suggest an automated software engineering technology that is appropriate, and explain how it can benefit from Borsoft's compiler technology expertise.

c Software process modelling and technology became a "hot topic" in software engineering following a seminal paper published by Leon Osterweil entitled "Software Processes Are Software Too" in the Proceeding of the 9th International Conference on Software Engineering in 1987.

Briefly discuss the perceived advantages and the actual difficulties of implementing successful "process programming".

The three parts carry, respectively, 30%, 45% and 25% of the marks.

End of paper