

UNIVERSITY OF LONDON  
IMPERIAL COLLEGE OF SCIENCE, TECHNOLOGY AND MEDICINE

EXAMINATIONS 2000

MSc in Computing Science  
for Internal Students of the Imperial College of Science, Technology and Medicine

PAPER M225

SOFTWARE ENGINEERING

Thursday 18 May 2000, 14:00  
Duration: 120 minutes

*Answer THREE questions*

Paper contains 4 questions

- 1a Briefly distinguish Validation and Verification (V&V), and explain why the V&V process would benefit from making requirements measurable.
- b Reformulate the requirement “the system shall be secure” into a form that is more measurable. Explain your approach.
- c Distinguish inheritance and aggregation. Give an example to support your distinction.
- d The following is the specification of Jack’s working week. If Jack’s bedside alarm does not ring, then he continues to sleep. If the alarm rings and it is not the weekend, then Jack wakes up and goes to work. If the alarm rings and Jack is feeling ill, then he continues to sleep.
  - i) Draw a decision table describing Jack’s working week as specified above.
  - ii) Is the specification consistent? Complete? Expand the decision table in part (i) to explain your answer.
  - iii) In what way do decision tables complement data flow diagrams? Suggest another way to add control information to data flow diagrams.

*The four parts carry, respectively, 20%, 10%, 20%, 50% of the marks.*

- 2a i) Briefly describe the kind of information that state transition diagrams model.
- ii) Explain one problem with using state transition diagrams, and explain how statecharts address this problem.
- b A real-time lecturer evaluation system behaves as follows. Students rate lecturers as either *poor*, *OK* or *excellent* (by pressing the appropriate button). By default, a lecturer's rating is *OK*. If a lecturer gives a good lecture, then the students rate the lecture as *OK*. If the lecturer gives a bad lecture, the students rate him as *poor*. If the lecturer gives the students exam hints in his lecture, they rate him as *excellent*, but only if the students have not been given the same hints before. While the lecturer's rating is *excellent*, he smiles, and while his ratings are *poor*, he frowns.
- i) Draw a state-transition diagram that models the behavior of the lecturer above.
- ii) A lecturer is either depressed or happy, depending on his rating by students. When he gives a lecture and students rate him as *excellent* or *OK*, he is happy, but when they rate him as *poor*, he is depressed. By default, he is a happy lecturer. Extend the state transition diagram in part (i) into a statechart, taking into account the lecturer's mood.
- c State transition diagrams are well suited to describing use cases involving one object. Suggest and briefly explain an alternative notation for describing use cases involving multiple objects.

*The three parts carry, respectively, 30%, 50%, 20% of the marks.*

- 3a Briefly outline the engineering and economic arguments to support the need for requirements engineering?
- b What is functional decomposition? Briefly explain why it is often unsuitable for dealing with the development of large, complex systems.
- c i) According to Michael Jackson, what are problem frames and why are they useful in software development? Give one example of a problem frame to illustrate your answer.
- ii) Distinguish indicative descriptions from optative descriptions, and give an example of each kind.
- d i) In developing software for your group project at Imperial College, comment on the maturity of your development process, and briefly discuss ways in which you can improve your process maturity. Use the CMU/SEI's Capability Maturity Model to explain your answer.
- ii) At what level of process maturity is it appropriate to introduce requirements engineering. Briefly explain your answer.

*The four parts carry, respectively, 15%, 15%, 30%, 40% of the marks.*

- 4a Explain briefly the role of inspection in requirements engineering, and provide an outline of an inspection process of a requirements document.
- b Outline a requirements elicitation process for a web-based system to collect and process student feedback on taught courses at Imperial College. State and briefly justify:
  - i) the stakeholders for which requirements have to be elicited,
  - ii) the type of information you want to collect, and,
  - iii) the technique you would use to elicit requirements in this particular case.
- c Briefly describe a technique for validating the requirements elicited in part (b).

*The three parts carry, respectively, 25%, 60%, 15% of the marks.*