Two hours

UNIVERSITY OF MANCHESTER
SCHOOL OF COMPUTER SCIENCE

Software Engineering 1

Date: Friday 23rd May 2008
Time: 14:00 – 16:00

QUESTION PAPER MUST NOT BE REMOVED FROM THE EXAM ROOM

Please answer ALL Questions in Section A
Answer the COMPULSORY Question in Section B
and answer ONE Question in Section C

Use a separate answerbook for EACH section

The use of electronic calculators is NOT permitted.
Section A

Answer all questions, each is worth 1 mark

A1. Within UML diagrams, name two diagrams which are behaviour diagrams and two diagrams which are structure diagrams.

A2. What are the main differences between the activity diagrams without partition and with partition?

A3. What does the ball and socket shape represent in the following Component Diagram?

A4. For the following state machine diagram, what are the states and what does the transition (open [door is closed]/push) mean?

A5. What is the definition of coupling? Briefly describe the software design principle related to coupling?

A6. Briefly describe the similarities and differences between the state machine and time diagrams.

A7. What are the main steps of the Data Flow Design Method?

A8. Among black box and white box testing methods, which method requires no knowledge of the program code or design?

A9. What is software testing?
A10. Why are structured walkthroughs and inspections similar verification techniques?

A11. What does the deployment diagram show?

A12. Why is prototyping believed to be a good method of designing software systems?

A13. What differentiates the spiral model of the software lifecycle from the waterfall and prototyping models?

A14. What does a class diagram specify?

A15. When should a test plan be defined?

A16. How will an engineer know that a set of requirements is consistent?

A17. What are non-functional requirements?

A18. You have been tasked to undertake a development project for a client who wants to clearly see the process being followed. What lifecycle model would you follow?

A19. How does the spiral lifecycle model differ from the waterfall, prototyping, and incremental models?

A20. Approximately how much of the software lifecycle is taken up by maintenance?
Section B

Compulsory - answer both parts of the question

B1. a) Draw class diagrams to represent the following.

i) An image can be made up of one or more layers. Each layer is made up of a number of pixels arranged as a rectangular array of rows and columns. The pixels can be 1, 4, 8 or 16 bit integers or floating point values. Each layer is the same size, and all the pixels in the image are of the same type. As well as recording the image data, the number of layers, the size and type of the image must be recorded. (5 marks)

ii) An audio clip can be sampled at a user-defined sampling rate (number of samples per second), and at a user-defined resolution (bits per sample) and in stereo or single channel. The data can be compressed in one of a fixed number of formats. The length of the clip is not known in advance, so it is to be stored in a sequence of segments; new segments are created as required. (5 marks)

b) Briefly answer the following questions:

i) What is modularity and why does it help to overcome the complexity of large scale software? (5 marks)

ii) What are the main verification techniques? Why can testing not be replaced by other verification techniques? (5 marks)
**Section C**

**Answer ONE question in this Section**

C1. You have been given the contract to design a home automation system. It will be used to control the alarm, heating, cooling, lighting and entertainment systems, and to record energy usage. It is to be accessed via a PC in the home or at a remote location, via simple terminals that provide restricted functionality in each room, or via a mobile telephone. A password is required for access to the system from a remote PC or via mobile phone.

The system will be tailored to a specific house. The householder will be able to override the default settings and will also be able to reprogramme the system.

a) Translate this description into a use-case diagram for this system.  

b) Using this diagram, design a suitable class diagram to represent the home automation system.  

c) Translate the class diagram into sequence diagrams that reflect the operation of turning the alarm on by accessing the system via a mobile phone.
C2. Suppose that a (text) use case is given in the following:

Check Schedule Use Case

*Basic Flow (also called Main Success Scenario):*
1. The user login (to view his or her schedule).
2. The system validates the user.
3. The system retrieves the user's personnel information (name, address, travel information, credit card information).
4. If correct, the user confirms the personnel information.
5. If incorrect, the user updates the personnel information.
6. The system retrieves the user’s itinerary.
7. The system presents the schedule to the user.
8. The user logout.

*Exceptional Flow (Also called Extensions):*
1. At Step 2 of the Basic Flow, if the user is not authenticated, then the following message is displayed:
   
   You have provided an incorrect user ID and/or password; please re-enter.
   
   The flow resumes at Step 2.
2. At Step 6 of the Basic Flow, if the itinerary is unavailable, then the following message is displayed:
   
   The traveller itinerary is not available; you cannot view your schedule at this time.
   
   The use case ends.

a) Use the activity diagram without partition to describe the above use case. 
   (6 marks)

b) Use the activity diagram with partition to describe the above use case. 
   (4 marks)

c) For each of the following test types, which testing technique (choosing between white and black box testing) is the right one for it and why?

i) Unit test
ii) Integration test
iii) System test
iv) Acceptance test

(10 marks)