

**One hour and 30 minutes**

*This paper will be taken on-line and this is the paper format that will be available as a back-up*

**UNIVERSITY OF MANCHESTER  
SCHOOL OF COMPUTER SCIENCE**

**Software Engineering**

**Sometime in January 2011**

**Time: Sometime**

Answer ALL the multiple choice questions in section A and ONE question from section B.

For full marks your answers should be concise as well as accurate.

Marks will be awarded for reasoning and method as well as being correct.

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The use of electronic calculators is not permitted.

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*Section A is a multiple choice  
section and is therefore  
restricted*

## Section B

Answer one of the two questions in this part.

2. Read the following scenario and then answer all the questions below.

A medical laboratory scientific officer (MLSO) receives many blood samples every day. A whole battery of tests are applied to these (according to a form filled out by a doctor). The MLSO performs each test and records the results on the form. These are transferred to a blood test results database by hospital administrators. Doctors can then consult print outs from the test result database to check on information about their patients.

The hospital wants a software system to support the process from the filling of the test request form by the doctor back to the doctor finding and reviewing the results. The hospital has to be aware of patient confidentiality and the prevention of errors in both specification and input of results. Hospital management wants a zero rate of errors in data input, but realistically sets the level at one in one thousand individual test recordings.

The new system will replace the current, largely paper based system. Doctors will specify tests for patients via a computer; these will go to hand-held devices for nurses. the nurse will take the blood, in a manner stated by the hand-held device and transfer the patient's identifier and test request identifier to the sample bottle and then sign off the sample taking stage of the test. The blood sampling procedures are recalled from a database of standard operating procedures (SOP) that is maintained by another part of the NHS. The SOP must be displayed in a way that minimises errors in the sometimes fraught hospital environment.

The samples arrive for the MLSO to process; the MLSO loads the samples into a machine; specifies the tests to be run by using the patient's identifier and the test record number (stored in the test request database). If a blood sample is damaged, the blood test request is re-issued to the relevant nurses. The blood testing machine feeds its data into the new system and the system records these in a database. The MLSO removes the sample bottles from the test machine and these are then disposed of by a laboratory orderly. Reports can be requested by doctors who are notified, via their pagers or mobile telephones, as to when test results are available. If the blood test machine fails, the relevant nurses are re-notified about the blood test request. If results take more than 3 days, a warning must be sent to the doctor concerned, the nurses and the MLSOs.

- a) What non-functional requirements are mentioned in this scenario? (2 marks)
- b) What functional requirements are mentioned in this scenario? (2 marks)
- c) Draw an activity diagram that captures the business process in this scenario (state any assumptions you make.) (6 marks)
- d) What are the use cases and their associated actors in the new system? Write each use case and its participating actors together. State any assumptions that you have made. (6 marks)
- e) What styles of user interaction are implied by the information you have in this scenario? State the style or styles of user interface; the basis of your decision and any assumptions that you have made. (4 marks)

3. a) i) Briefly explain what a structural model is. (2 marks)  
 ii) Briefly explain what a behavioural model is. (3 marks)

b) Consider the following scenario:

A video rental shop is run by a manager and several shop assistants. The manager maintains the catalogue of videos, while the shop assistants deal with the customers. The shop is planning a computer system to help run the shop. Before it can be put on the shelf, a video must be catalogued and entered into the video database. Every customer must have a valid customer card in order to rent a video. Every time a customer rents a video, the system must ensure that the customer does not have any overdue videos. Overdue videos must be returned and an overdue fee paid before the customer can rent more videos. Likewise, if the customer has returned overdue videos, but has not paid the overdue fee, the fee must be paid before new videos can be rented. If a video is returned in damaged condition, the manager removes it from the video database and may sometimes charge the customer.

The use case diagram is as follows:



- i) Identify domain classes and their relationships, and draw the domain class diagram. Explain and justify your answer. (5 marks)  
 ii) Suggest suitable system classes and show how they refine the domain classes. Draw a class diagram for the system classes. (5 marks)  
 iii) Draw a sequence diagram to show how the use case 'Issue video to customer' is realised by your system classes. (5 marks)