UNIVERSITY OF EDINBURGH

FACULTY OF SCIENCE AND ENGINEERING

COMPUTER SCIENCE THREE

SOFTWARE ENGINEERING WITH OBJECTS AND COMPONENTS 1

Tuesday 12 September 2000

14:00 to 15:30

Examiners:

Prof. K. Turner (External)

Prof. G. Brebner (Chairman)

INSTRUCTIONS TO CANDIDATES

Answer any TWO questions.

All questions carry equal weight.

1. Consider the following problem:

> The Division of Informatics wishes to implement a system for controlling the issuing of lecture notes to students. This currently requires a secretary to record when the supply of any particular note is exhausted, when a student takes a copy of a particular note, which students have not taken any copies and which have taken multiple copies. These tasks should be automated, so that the student enters the notes being taken.
>
> The secretary should now only need to update the current totals occasionally, to correct any mistakes and omissions. It should also be possible for the secretary to add new copies of a particular note.
>
> A lecturer should be able to check that information for his or her module.

   (a) Describe a method you might use to derive a preliminary class model from this textual description of the system. [*5 marks*]

   (b) Ignoring the user interface aspects of the system, use the method to construct such a class model. The preliminary class model should identify the classes and their associations, but need not specify attributes or methods. You should label the associations with suitably descriptive labels and any multiplicities. [*7 marks*]

   (c) Briefly describe how interaction diagrams may be used to validate a class model with respect to a set of use cases. [*5 marks*]

   (d) Use interaction diagrams to check the validity of your class model with respect to the following use cases (you should both draw the interaction diagrams and briefly describe *how* they validate these particular use cases): [*8 marks*]

      i. The secretary wishes to identify those modules for which the supply of any notes is currently exhausted.

      ii. A student was absent for part of one particular module, and asks the secretary to check which notes he or she is missing from that module.

      iii. The Division of Informatics decides to add an entirely new module for the coming academic year. The system must be updated to accommodate this new module.

2. Consider the following brief description of the process of setting examination papers:

> Individual lecturers write draft papers, these are then scrutinised at a meeting and revised in line with comments generated at the meeting. These are then sent to the external examiner who reviews them, sends back comments to the year organiser who ensures the individual lecturers carry out the required changes. The papers are then ready for use.

(a) In what ways may two classes A and B be associated? [*4 marks*]

(b) Construct a use case diagram and corresponding use cases for the above process. For each of your use cases you should include brief written descriptions of the main tasks involved [*8 marks*]

(c) Use an activity diagram to show how the individual activities in the use case diagram combine to create the workflow for this process. Pay particular attention to the synchronisation of activities. [*8 marks*]

(d) Draw one simple UML statechart diagram which illustrates the following features:

i. entry and exit actions

ii. event/action pairs

iii. concurrency

You should accompany your diagram with brief descriptions of how these features are represented. [*5 marks*]

3. (a) 'Components are units of reuse and replacement.' Identify at least four features or properties which a more detailed definition of components might include. [*5 marks*]

(b) Draw a collaboration diagram which corresponds to the following sequence diagram: [*8 marks*]

(c) "The use of object-oriented concepts and UML modelling can lead to higher quality systems."

i. How does modelling in UML contribute to design quality? [*4 marks*]

ii. Why do users often find it difficult to clearly express their system requirements? [*4 marks*]

iii. Under what circumstances can the use of inheritance in an object-oriented system lead to a reduction in quality? [*4 marks*]