UNIVERSITY OF EDINBURGH

FACULTY OF SCIENCE AND ENGINEERING

COMPUTER SCIENCE THREE

SOFTWARE ENGINEERING WITH OBJECTS AND COMPONENTS 1

Saturday 9 June 2001

09:30 to 11:00

Examiners:

K. Turner (External)

G. Plotkin (Chairman)

INSTRUCTIONS TO CANDIDATES

Answer any TWO questions.

All questions carry equal weight.

1. Consider the following informal description of the organisation of a Scottish museum:

   > The museum contains a number of galleries and employs several curators. Each gallery has between one and three curators who organise the exhibitions for that gallery. Exhibitions are used to display the artifacts which the museum owns. As there is insufficient space to display all artifacts at once, artifacts not on display are kept in museum storage. Every artifact has a record describing it. Occasionally the museum will loan its artifacts to other Scottish museums, or borrow artifacts from them. The loan of artifacts is handled by the museum curators, who deal directly with the Intra-Scotland Museum Loans Organisation.

   (a) Identify the qualities that make up a "good" software system. [*5 marks*]

   (b) Use noun-phrase identification, or any other appropriate technique, to construct a class model from the above description of a Scottish museum. 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. It is a requirement that *Artifact* be a class in your model. [*8 marks*]

   (c) What are the (half a dozen or so) more common mistakes which can be made in the construction of an OO domain model, such as your class model for the above system? [*6 marks*]

   (d) Consider this further information concerning the handling of museum artifacts:

   > The record for an artifact must also state whether it is currently in display, in storage or on loan. Artifacts may only be loaned if they are currently in storage, and are placed in storage whenever they are returned from loan. The record for an artifact also states whether it is in good condition or not. Wherever the artifacts are, their condition is constantly monitored. If an artifact is found to be in poor condition, then it is recorded as being in need of restoration. This record is updated after restoration, which may happen at any time.

   Construct a UML statechart for your *Artifact* class based upon this more detailed description. Choose appropriate class method names to label transitions between states. [*6 marks*]

2. (a) For each of the following potential software development problems, give one example where it has led to a serious failure, and briefly discuss how software engineering with objects and components would have helped to avoid the problem:

   i. missed or misunderstood requirements [*3 marks*]

   ii. inappropriate software reuse [*3 marks*]

   iii. poor project management [*3 marks*]

(b) Consider the following brief description of the process of organising an academic project workshop:

> The project director invites project members to attend the workshop and asks a secretary to arrange some accommodation. The secretary contacts a hotel manager to make a provisional booking. Meanwhile project members respond to the director if they are interested in attending the workshop. At some set date the director will inform the secretary of these expressions of interest and instruct project members to confirm their accommodation booking with the secretary. At a second set date the secretary will collate the accommodation requests from project members and inform the hotel manager. The organisation of the workshop is then complete.

Construct a use case diagram and corresponding use cases for this 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 combine to create the workflow for this process. Pay particular attention to the synchronisation of activities. [*8 marks*]

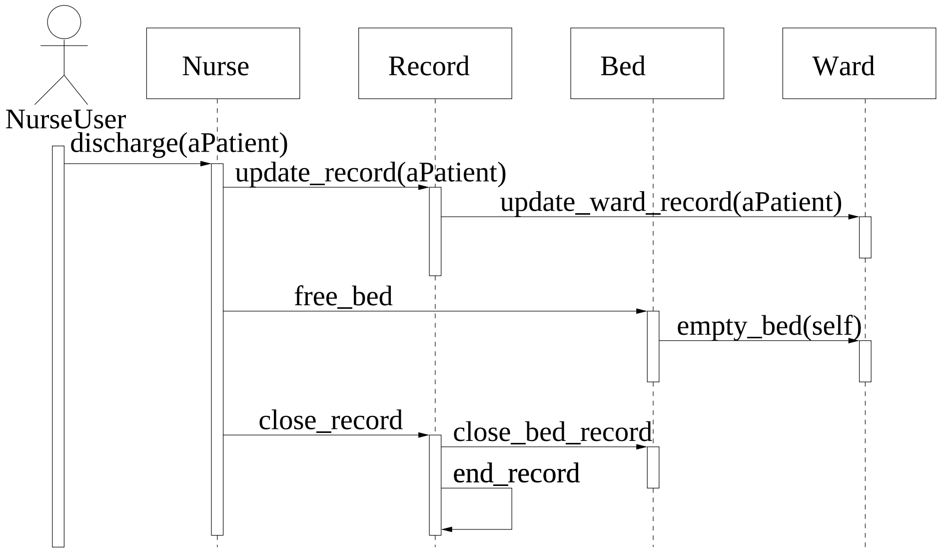
3. The designers of a Hospital Information System have chosen to adopt a component-based development approach. In reviewing their initial class model the designers have the following priorities:

- validating the associations between classes;
- exploring the dynamic interactions between classes;
- creating components out of combinations of classes.

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

(b) Draw a collaboration diagram which corresponds to the designers following sequence diagram. To indicate the sequencing of messages you should add appropriate labels to your collaboration diagram.

[*8 marks*]



(c) The designers accept the definition: "Components are units of reuse and replacement".

i. Identify at least four features or properties which a more detailed definition of components might include. [*5 marks*]

ii. Briefly discuss the advantages of component reuse over other forms of software reuse. [*4 marks*]

iii. Briefly discuss the difficulties and/or pitfalls of component reuse. [*4 marks*]