UNIVERSITY OF EDINBURGH

FACULTY OF SCIENCE AND ENGINEERING

MASTER OF SCIENCE IN COMPUTER SCIENCE

SOFTWARE ENGINEERING WITH OBJECTS AND COMPONENTS 2

Monday 23 April 2001

09:30 to 11:00

Examiners:

I. Watson (External)

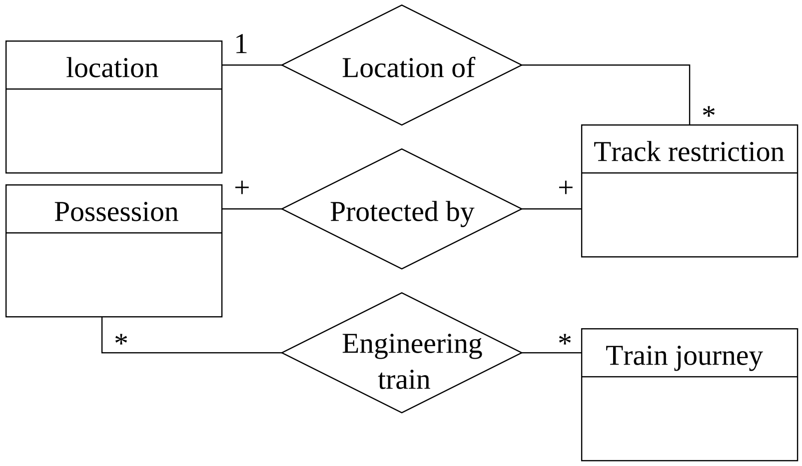
R.N. Ibbett (Chairman)

INSTRUCTIONS TO CANDIDATES

Answer any TWO questions.

All questions carry equal weight.

1. The following diagram (taken from your practical exercise) shows part of a data model relating to possessions of segments of railway track by maintenance engineers.



You are asked to design a system for scheduling possession of railway track segments.

(a) Describe the overall architecture of your system using **one** of the following architectural patterns: blackboard, broker, layers, microkernel, model-view-controller, pipes and filters, presentation-abstraction-control, reflection. Explain how your chosen architectural pattern fits the problem and justify your choice with respect to key characteristics of the pattern. [*13 marks*]

(b) "Black box" testing requires that we identify, from all the possible input test data and without examining the internal structure of the system, subsets of the input data which give a high expectation of revealing defects in our system. Briefly describe one systematic way of doing this and explain how it might apply to the architecture you gave in part (a) above. [*3 marks*]

(c) "White box" testing uses the internal structure of program code to derive test data. Briefly describe one systematic way of doing this and explain how it might apply to the architecture you gave in part (a) above. [*5 marks*]

(d) Having tested individual system components we must then consider whether they can be integrated without introducing defects at the interfaces between components. Briefly explain the sorts of errors which are typical at this integration stage and suggest one general strategy for integration testing. [*4 marks*]

2. The Unified Process is an example of an incremental design lifecycle based on a uniform representation (in UML) for design models.

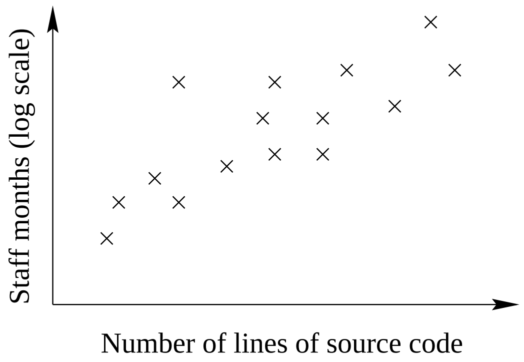
   (a) In the Unified Process there is an interaction between three different concepts of design stage: the phases of the lifecycle; the stages in workflow; and the iterations of design. Describe each of these concepts and explain how they interact. [*8 marks*]

   (b) Use cases are a style of modelling used within the Unified Process to integrate other models (such as those for analysis and for design). Explain briefly how this is done. [*7 marks*]

   (c) Extreme Programming has been advocated as an alternative to incremental design methods like the Unified Process. Explain briefly the difference between these two methods. [*5 marks*]

   (d) Extreme programming imposes twelve "practices" to which designers should adhere. Describe two of these and explain why they are essential to the method. [*5 marks*]

3. The diagram below shows a plot of number of staff months taken to produce programs of different sizes (where size is measured by number of lines of code). The points on the plot are taken from historical data from programmers working on various similar projects for the last ten years.



Using this and other information you intend to estimate the size of a future project.

(a) How might you use the data from the plot above to estimate the amount of effort needed on your new project? What are the problems in doing an estimate in this way? [*5 marks*]

(b) A more detailed method of size estimation is by using function points. Explain briefly what this method involves and explain its weaknesses. [*8 marks*]

(c) Before you begin to design your system you want to predict commonly occurring risks during the design process. Sources of these as: imperfect knowledge of the problem; teamwork difficulties; lack of productivity; ambiguity over ownership; distractions; and training overheads. Choose any two of these sources and describe a pattern of risk reduction for each of them. [*10 marks*]

(d) If size and risk are so hard to predict in software projects, why do we attempt to quantify them? [*2 marks*]