

1CS88 Object Modelling Paper

Instructions. Credits will be given for the best two answers only.

Question 1 and 2 are based on the following university environment.

Students live in the university environment. The university provides services to students. Students can register for up to eight modules by going to the appropriate Faculty building, contacting a member of the administrative staff and filling an appropriate form. Students attend lectures and sit exams on these modules. Each module is defined by its syllabus, a timetable, its course material (this may include books, slides, notes, videos) and an exam paper. Some of the modules include a coursework component. Each module is set up (by defining the syllabus, the coursework component if needed and all the course material) and taught by a member of the staff. Members of academic staff are classified into research assistants and lecturers and grouped into Departments each of which is part of a Faculty. Sometimes graduate students are also members of staff if they are employed as teaching assistants. All members of staff except research assistants can teach up to three modules. Research assistants can only teach one module. Modules are taught using lectures according to a specified timetable.

Question 1.

- (a) Describe the process of defining the requirements of a system through use-case diagrams by
 - (i) defining the components of a use-case diagram; **(3 marks)**
 - (ii) describing the graphical notations which can be used to represent these components, and **(3 marks)**
 - (iii) saying how these components can be identified. **(4 marks)**
- (b) Construct the requirement model for the university environment based on the description above. Describe at least three of the use-cases using activity diagrams. **(15 marks)**

Question 2.

- (a) For each of the following pairs give a definition and an example for each term using either a graphical notation (e.g. OMT, UML) or a programming language (e.g. C++, Java).

- (i) object, class; (2 marks)
 - (ii) inheritance, multiple inheritance (3 marks)
 - (iii) binary association, k -ary association; (3 marks)
- (b) Explain with an example why a k -ary association is not equivalent to k binary associations. (4 marks)
- (c) Draw an object diagram for the university environment described above. Keep a special focus on the part of the system that relates students, lecturing staff and taught modules. Use inheritance hierarchies and aggregations. (13 marks)

Question 3.

- (a) After the analysis is completed the object oriented development process proceeds to the system and object design stage. List, with a brief description, the different phases of the system and object design stage. (13 marks)
- (b) Explain how UML notations formalise the different phases in the design stage in a cleaner way than OMT. (Your answer should define all graphical and textual notations used in UML for the design). (12 marks)

Question 4.

- (a) Describe with an example how you would implement the following using a non-object-oriented language such as ADA or C.
- (i) a class; (3 marks)
 - (ii) a particular object (allocating storage for it); (3 marks)
 - (iii) inheritance; (7 marks)
- (b) In the context of an Object Oriented language,
- (i) Describe what dynamic binding means, and give an example. (6 marks)
 - (ii) Describe two ways in which dynamic binding is implemented in modern object oriented languages giving details about the construction and access time in each case. (6 marks)