

Birkbeck
(University of London)

BSc/FD EXAMINATION

Department of Computer Science and Information Systems

Information Systems Management (COIY019H5)

CREDIT VALUE: 15 credits

Date of examination: 1st June, 2015

Duration of paper: 2 hours (2:30pm to 4:30pm)

There are **six** questions on this paper.

Answer only **four** of the six questions.

Each question carries **25** marks in total. Questions indicate marks for sub-questions.

If more than four questions are attempted, only marks from four questions will be reported as your examination mark.

No extra materials are required or allowed.

1. Reuse

- (a) Discuss the *white box* approach to reuse by Jacobson et al.; in particular, illustrate the various mechanisms in this approach. (13 marks)

Architectures (with application to reuse)

- (b) Briefly describe the *three-layer architecture* for information systems and briefly explain why it is useful for reuse. (12 marks)

2. **Project Management** Consider the PERT diagram showing the tasks of a project, depicted in Figure 1; tasks are indicated as arc labels (T_1, \dots, T_{13}), and the duration ($T_1, 4$ meaning that T_1 has duration 4) is indicated in weeks.

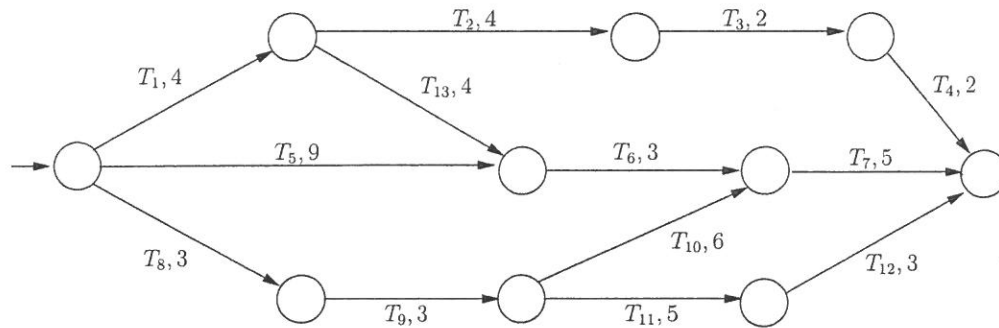


Figure 1: PERT diagram for Question 2.

- Identify the critical path(s) and give its (their) duration. (3 marks)
- Give the earliest start time and the latest start time for T_3 and T_6 . (9 marks)
- Suppose that, due to unexpected performances of the team working on it, the execution of T_6 takes 5 weeks instead of 3. Is the total duration of the project affected? If it is, how? (6 marks)
- A manager has the resources to reduce the time allocated to one task (*any* task but only one) by 2 weeks. Find what task the manager should choose in order to achieve the maximum reduction of the total duration of the project. Justify your answer. (7 marks)

3. Design patterns

- (a) Discuss the issues surrounding the use of the *Singleton* pattern. (11 marks)
- (b) Consider the diagrams in Figure 2, which depict classes representing elements of a filesystem. The diagram (I) expresses that files are nodes in the filesystem; the diagram (II) expresses that a directory is a collection of files. Using the *Composite* pattern, draw a class diagram that combines the two diagrams in Figure 2.

Hint: notice that the combined diagram enjoys the following properties:

- a directory has the same interface as a file (as it happens in real filesystems, where files and directories are manipulated in the same way for most operations);
- rather than being a collection of files (as in Figure 2), a directory is a collection of elements that are either files or directories (files and directories share the same interface as above specified).

(9 marks)

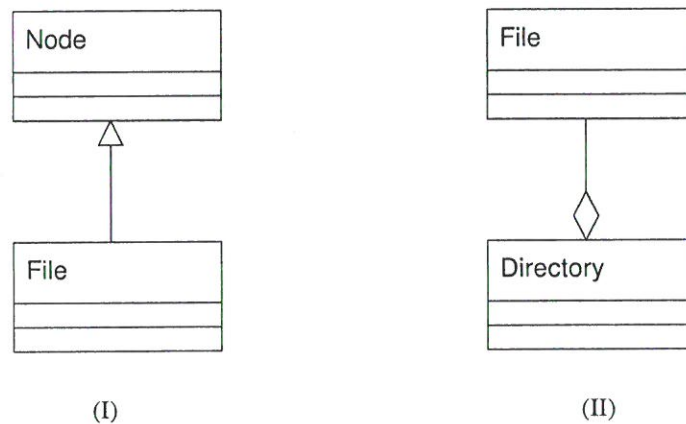


Figure 2: Diagram for Questions 3(b) and 3(c).

- (c) Briefly explain the use of *polymorphism* in the Composite pattern. Give an example with a function `size()` that returns the size of a node, whether it is a file or a directory. (5 marks)

4. Data management

- (a) Discuss the issues around relational database management systems (RDBMSs).
(6 marks)
- (b) Explain the main weakness of RDBMSs in their use with object-oriented systems.
(7 marks)
- (c) Describe the use of a single `PersistentObject` superclass in encapsulating the mechanisms to access persistent data.
(12 marks)

5. System design and architecture

- (a) Describe the principles behind a partitioned architecture. (11 marks)
- (b) Discuss the issues around the *Model-View-Controller* architecture. (14 marks)

6. Detailed design

- (a) Explain the role of the different types of visibility in class design. (5 marks)
- (b) Explain the notion of *cohesion* and its three variants *operation cohesion*, *class cohesion* and *specialisation cohesion*. (11 marks)
- (c) Consider the class diagram in Figure 3. Notice that, in the diagram, office rooms are generic rooms that can either be used as staff rooms by employees or as meeting rooms; each employee occupies exactly one room, and each meeting is held in exactly one room; this is represented by inheriting all fields (attributes and operations) of the class `OfficeRoom` in both classes `Employee` and `Meeting`. Explain what kind of cohesion the diagram lacks. Suggest a change to improve cohesion in this design. (9 marks)

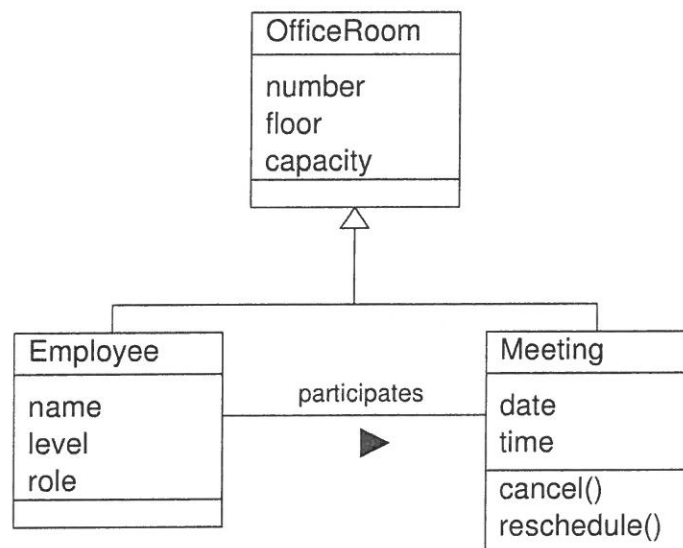


Figure 3: Diagram for Question 6(c).

