

UNIVERSITY OF LONDON  
IMPERIAL COLLEGE OF SCIENCE, TECHNOLOGY AND MEDICINE

EXAMINATIONS 1997

BEng Honours Degree in Computing Part II  
MEng Honours Degrees in Computing Part II  
BSc Honours Degree in Mathematics and Computer Science Part II  
MSci Honours Degree in Mathematics and Computer Science Part II  
for Internal Students of the Imperial College of Science, Technology and Medicine

*This paper is also taken for the relevant examinations for the  
Associateship of the Royal College of Science  
Associateship of the City and Guilds of London Institute*

PAPER 2.7 / MC2.7

SOFTWARE DESIGN II

Wednesday, May 7th 1997, 2.00 - 3.30

*Answer THREE questions*

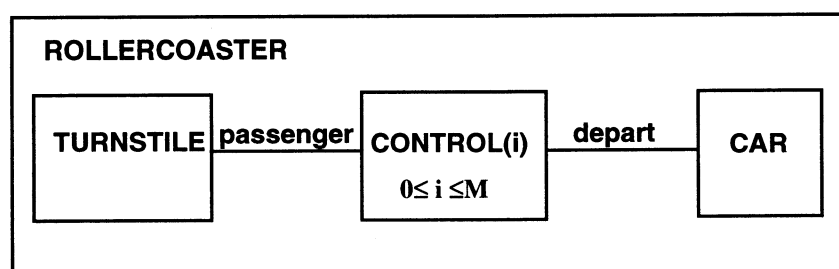
For admin. only: paper contains 4  
questions

**Section A** (Use a separate answer book for this Section)

- 1a Explain how and why the keyword **synchronized** is used in multi-threaded Java programs. In addition, briefly explain the function of the methods **notifyAll()** and **wait()**.
- b A set of processes share three printers. Before using a printer, a process calls the method **int request()** to return the identity of a free printer. This method is provided by a printer allocator object which is an instance of the **class Pallocator**. When a process is finished with a printer, it calls the method **void release(int printer)**. Provide an implementation for the **class Pallocator** in Java.
- c What invariant does **class Pallocator** preserve?

*The three parts carry, respectively, 25%, 60% , 15% of the marks.*

- 2a Explain what is meant by a shared event in the context of the process modelling notation used in the lecture notes.
- b A roller coaster control system only permits its car to depart when it is full. Passengers arriving at the departure platform are signalled to the roller coaster controller by a turnstile. The controller signals the car to depart when there are enough passengers on the platform to fill the car to its maximum capacity of  $M$  passengers. The car then goes around the roller coaster track and then waits for another  $M$  passengers. A maximum of  $M$  passengers may occupy the platform. Ignore the synchronisation detail of passengers embarking from the platform and car departure. The diagram below models the roller coaster system as processes communicating by shared events.



Using the process modelling notation from your lecture notes, give a complete specification of the ROLLERCOASTER system.

- c Transform your specification for CONTROL into a monitor implemented in Java.

*The three parts carry, respectively, 20%, 40% , 40% of the marks.*

**Section B**      (*Use a separate answer book for this Section*)

- 3a Briefly describe four methods of user interface evaluation, indicating when and why it is appropriate to use each one.
- b Briefly describe the Keystroke Level Model (KLM) of evaluation. Give one of the weaknesses of this model, and suggest an alternative model that addresses this weakness.
- c You have been asked to evaluate a library information service that answers queries on the availability and location of books in the library.
- Briefly describe how you would evaluate this system, indicating the expected products of the evaluation and why they are useful for re-designing the system.

*The three parts carry, respectively, 40%, 30%, 30% of the marks.*

- 4a Briefly describe two factors that influence the choice of main input device (e.g., keyboard, mouse, joystick) for a graphical drawing package.

Would your choice differ if the application were a word processor? Why?

- b Consider the overall task of searching for information about a book using a computer-based library information system (e.g., searching for location of a specific book, books by a certain author, books on a specific topic).

In executing the above task, briefly state one advantage and one disadvantage of using the following dialogue styles. [*Hint*: you may want to consider issues like the type of search, the information searched, and the type of user].

- i) form-filling
- ii) menus
- iii) a command language
- c Draw a Hierarchical Task Analysis (HTA) diagram for the joint task of finding book information/location using the library information system described in part b. Explain the notation you use.

*The three parts carry, respectively, 30%, 30%, 40% of the marks.*

*End of paper*