# UNIVERSITY OF LONDON

## IMPERIAL COLLEGE OF SCIENCE, TECHNOLOGY AND MEDICINE

## EXAMINATIONS 1996

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

Thursday, May 2nd 1996, 2.00 - 3.30

*Answer THREE questions*

For admin. only: paper contains
4 questions
2 pages (excluding cover page)

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

1a Suppose 20 processes share 5 printers. Before using a printer, processes call the monitor access function `request` to request a free printer. This function returns the identity of a free printer in the range 0 to 4. After using a printer, processes make it available to other processes by calling the monitor access function `release`.

Develop a monitor that implements the required synchronisation and includes the following access functions:

```
int request (void);              // returns printer ID

void release (int printerID); // release requested printer
```

b Now assume that each process has a urgency in the range 0 (least urgent) to 9 (most urgent) that it passes to the monitor as an additional argument to `request`. Modify the monitor so that a printer is always allocated to the most urgent waiting process. If two or more processes have the same level of urgency, requests are to be granted in first-come, first-serve order.

```
int request (int urgency);      // returns printer ID

void release (int printerID); // release requested printer
```

State any additional assumptions that you make .

2 Suppose there are 3 processes A, B and C each of which has its own local array of 100 integers and that there **is at least one** integer value which is in all three arrays.

Develop a **synchronous** message-passing program in which the 3 processes interact to determine the **smallest** common value in the arrays. This value is to be printed out by each process before each process terminates.

Your answer should include:

i) an English description of the algorithm you devise

ii) component descriptions for A, B and C

iii) a labelled configuration diagram of the program

iv) the process code for A, B and C.

You can use the following search function in your code:

```
int search (int N, int Array[]);
          // returns 1 if N is found in Array, 0 otherwise
```

Messages must only contain one integer value at a time. In addition, processes cannot access or hold arrays other than their local array.

State any additional assumptions that you make.

**Section B** *Use a separate answer book for this section*

3a Briefly summarise the main products and processes in evaluating user interfaces.

b You have prototyped an entirely new display system for a large distribution company. The display will be used by operations staff, 24 hours a day. The users need to see four different parts of a huge network in order to monitor and control the supply of the company's service. The network is too large to be seen in detail as a whole on one screen. You have a choice between two output formats: one high resolution 17" monitor with four windows, or four medium resolution 12" monitors.

i) Briefly describe the factors which should be considered in positioning the displays.

ii) Presuming that the system has been designed to support agreed tasks, describe how you would plan and perform an evaluation to determine which was the better physical device for the display.

*Parts a, b(i) and b(ii) of this question carry, respectively, 30%, 20% and 50% of the total marks.*

4a Using an appropriate notation, give a hierarchical breakdown of the joint task of selling & buying a train ticket from dispenser similar to those used by London Underground, which also sells travelcards of varying range and duration.

b Show how the dialogue and states of interaction can be represented diagrammatically. What is the relation between this diagram and your notation for part *a*?

c Briefly describe the dialogue styles which are used.
How much could be retained if tickets were to be ordered via a web browser?

*The two parts of this question carry, respectively, 40%, 40% and 20% of the total marks.*