

**COMPUTER SCIENCE  
STANDARD LEVEL  
PAPER 2**

Tuesday 18 May 2004 (morning)

1 hour 45 minutes

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**INSTRUCTIONS TO CANDIDATES**

- Do not open this examination paper until instructed to do so.
- Answer all the questions.

1. Consider the following function.

```
function MINUTE (val real TIME) result integer
/* TIME represents a time in the form hours.minutes */
/* where HOURS should be a value between 0 and 23 */
/* the total minutes since midnight are returned */
  declare HOURS, MINUTES, TOTAL integer
  HOURS = truncate ( TIME )
  MINUTES = round ( (TIME - HOURS) * 100 )
  TOTAL = 60 * HOURS + MINUTES
  return TOTAL
endfunction MINUTE
```

Recall that **truncate** returns the integer part of a real number and **round** rounds a real number to the nearest integer.

e.g. **truncate**(12.59) returns 12

and

**round**(12.59) returns 13

- (a) State the values the function returns when the following values are passed as parameters.
  - (i) 2.45 [1 mark]
  - (ii) 3.78 [1 mark]
- (b) Amend the algorithm so that it returns the value -1 if the MINUTES value is invalid (*i.e.* it is bigger than 59 when rounded). [2 marks]
- (c) State **one** other example of an invalid parameter. [1 mark]

A bicycle rental shop needs to be able to calculate the difference between two times on the same day.

- (d) Construct a function that calls the amended function MINUTE to return the difference in minutes between two times on the same day which are passed as parameters. The function should return -1 if either of the parameters is an invalid time. It should not matter which way the times are passed to the procedure (earliest first, or latest first). [4 marks]

*(This question continues on the following page)*

(Question 1 continued)

In the rental shop system, the BIKEID and time OUT are stored in parallel arrays as follows.

	ID	OUT
[1]	ABC	9.55
[2]	DFK	10.11
[3]	XYX	10.23
[4]	...	...
...	...	...
[N]	ZZZ	0.0

The end of the BIKEID array is marked with the rogue value ZZZ. ID is a string array and OUT is an array of real numbers representing times. When a bike is returned, the following operations are needed:

- the ID is looked up in the ID array
- if the ID does not exist an error message is output
- the OUT time is found
- the current time is input and the difference between that and time OUT is output
- the two entries are deleted by shuffling values below by one place to the end of the array.

e.g. If the bike DFK had been returned the array would appear as follows.

	ID	OUT	
[1]	ABC	9.55	
[2]	XYX	10.23	
[3]	...	...	(DFK and 10.11 removed)
[4]	...	...	
...	...	...	
[N-1]	ZZZ	0.0	
[N]	ZZZ	0.0	

- (e) Construct the procedure to carry out the process described above. [11 marks]
- (f) Construct the procedure which takes a BIKEID and OUT time as parameters and adds them to the end of the arrays. You may assume the arrays are big enough for this purpose. [6 marks]
- (g) Suggest **one** other way of organizing the arrays such that a more efficient search could be carried out, and discuss the implications on efficiency of adding and deleting items. [4 marks]

*This question requires the use of the Case Study.*

2. (a) Discuss any **two** implications of Flexible Manufacturing Systems (FMS). *[6 marks]*
- (b) A FMS component might be a programming interface for a machine tool. Explain **one** way in which this might be implemented as a GUI. *[3 marks]*
- (c) A bus network is sometimes considered less reliable than a star network. Discuss **two** implications of reliability in an FMS. *[4 marks]*
- (d) Outline **three** reasons why distributed processing is used at the various levels in a factory wide network. *[6 marks]*
- (e) Compare wire frame, surface and solid modelling by discussing their suitability for assembly modelling. *[6 marks]*

3. A bicycle rental shop uses a computer system. Each bicycle has a card clipped to it. When the bicycle is rented the card is taken off and the bicycle ID and time out entered into a transaction file. When the bicycle is returned the bicycle ID is entered via the keyboard and the master file searched for the hourly rate. The cost of rental is calculated from the system time and from the time stored in the transaction file. This cost is printed on a receipt. If there is an error in searching the master file a message is output to the monitor screen and the ID re-entered.
- (a) Construct a systems flowchart of the bicycle return process. *[8 marks]*
- (b) Outline **two** ways in which the ID numbers could be entered directly into the computer from the card (instead of by typing at the keyboard). *[4 marks]*
- (c) The current system uses a command line interface.
- (i) Outline the main characteristics of a command line interface. *[1 mark]*
- (ii) State **two** advantages of using a command line interface instead of a GUI. *[2 marks]*
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