

MARKSCHEME

November 2001

COMPUTER SCIENCE

Higher Level

Paper 2

1. (a) 2 [1 mark]
algorithm gives array position [1 mark] instead of month number [1 mark] [max 3 marks]

(b) return P+1 instead of P [2 marks]

(c) **procedure** ADDHOURS
declare P,Q **integer**; SMONTH **string**
for Q=0 **upto** 11 **do**
 HOURS (Q) <-- 0
endfor
 SMONTH=""
input SMONTH
while SMONTH#"ZZZ" **do**
 P<-- 0
while SMONTH #MONTHS (P) **do**
 P<-- P+1
enddo
 HOURS (P) <-- HOURS (P) +1
input SMONTH
enddo
endproc

The above is only one possible solution. Candidates can use the given function MONTHNUMBER but it needs to be in the original form or P adjusted again if not.

Award marks as follows:

initialise the array HOURS [1 mark]

input month name [1 mark]

check for terminator [1 mark]

find month number [1 mark]

increment correctly [1 mark] [max 5 marks]

(d) *Award marks for each point as follows.* The way in which candidates express each point is not important as long as the strategy is clear.

- Input the month name and count the number of letters it contains (*i.e.* use LEN\$(SMONTH) [1 mark]

- for each entry in MONTHS [1 mark]

- initialise count

- for each letter in SMONTH [1 mark]

- compare with same POS letter in MONTHS [1 mark]

- if the same increment count [1 mark]

- if count > .8*LEN return month number and exit [1 mark]

- return -1 [1 mark] [max 7 marks]

(e) There are a few possibilities May and March similar for example, June July. Small number of letters would mean no chance of detecting *e.g.* Mag has only 66% the same as May [1 mark]

```
(f) MID<-- HOURS(5)
LEFT<--0
RIGHT<--11
QUICKSORT(LEFT,RIGHT,MID)

procedure QUICKSORT(ref LEFT, RIGHT, MID integer)
  while RIGHT>LEFT do

    while HOURS(LEFT)<MID do
      LEFT<--LEFT+1
    endwhile
    while HOURS(RIGHT)>MID do
      RIGHT<--RIGHT-1
    endwhile
    TEMP<--HOURS(RIGHT)
    HOURS(RIGHT)<--HOURS(LEFT)
    HOURS(LEFT)<--TEMP
    LEFT<--LEFT+1
    RIGHT<RIGHT-1
  endwhile
  if RIGHT>0 then
    LEFT<--0
    QUICKSORT(LEFT,RIGHT,MID)
  endif
  if LEFT<11 then
    RIGHT<--11
    QUICKSORT(LEFT,RIGHT,MID)
  endif
endproc
```

Allocate marks as follows:

initial setting of LEFT, RIGHT and MID *[1 mark]*

pass by reference of parameters LEFT and RIGHT *[1 mark]*

correct LEFT < RIGHT loop *[1 mark]*

correct loops to increment RIGHT and LEFT *[2 marks]*

swap of values at RIGHT and LEFT *[1 mark]* correctly *[1 mark]*

RIGHT and LEFT incremented/decremented *[1 mark]*

test for RIGHT and LEFT set to end *[1 mark]*

test for LEFT and RIGHT set to start *[1 mark]*

Any recursive call [1 mark] correct [1 mark].

2. (a) very small change in one element (for example wind) can have effect on all other elements **[2 marks]**
 small change in elements can affect the time and place that weather will arrive **[2 marks]**
 the equations have to be continually fed with these variables to give latest changes and cannot predict what next change will be **[2 marks]**
 prediction equations are too simple and use too few variables to hold for more than a short period **[2 marks]**

Any of the above and many more are acceptable. Give [1 mark] for reason and [1 mark] for explanation.

- (b) short term uses fewer variables and restricted number of equations **[1 mark]** whereas long term includes many complex equations and many more variables **[1 mark]**
 short term is repeated on measurements as they are sent now **[1 mark]** long term uses archived data and statistics **[1 mark]**
- (c) One advantage **[1 mark]** justified **[1 mark]** and one disadvantage **[1 mark]** justified **[1 mark]**.

For example, an advantage is that changing secondary storage would mean:

- more storage
- taking less space
- easier to mount/dismount
- quicker to access

Disadvantages:

- not compatible with archived data so far
- means rewriting all the old data onto new medium
- could mean changing software

- (d) sending data from collection centre to central computer **[1 mark]** or to regional television company **[max 1 mark]**
- (e) **[1 mark] for each of the following points [max 4 marks]**
- set up equations to accept data
 - feed in current variables
 - compare forecast with what actually happens
 - repeat over a period time that covers a wide range of seasons, temperature, humidity *etc.*
 - take archive data
 - from a wide range of conditions
 - feed variables into model
 - compare forecast with the known resultant climate

- (f) *Accept any of the following characteristics [1 mark] with reason for which suitable [1 mark]. Do not give more than [4 marks] for characteristics or [4 marks] for reason. [max 8 marks]*
- parallel processing or pipelining needed to perform millions of calculations
 - precision arithmetic since calculations complex and small errors could mean different forecast
 - large immediate access store (accept RAM) needed for the number of variables and results that have to be processed
 - fast processing speed since each calculation is complex
 - front end processor to deal with input and output of enormous number of variables and results
- (g) *Give [1 mark] for correct online and [1 mark] for correct batch process.*
- On line process:
- would be the acceptance of data from the collection points
- Batch process could be
- sending the current forecast after manipulation to the television centres at a set time each day
 - archiving data at a set time each day/week
- (h) *[1 mark] for any of the following:*
- no need to since data not secret
 - does not mean anything until put together with the rest of the data
 - saves time in sending and receiving
 - too much data to slow down with encrypting/decrypting
- (i) Data sent to regional television centres *[1 mark]* then resent to their own analysts *[1 mark]*.

3. (a) Row 999 *[1 mark]* column 2 *[1 mark]*
- (b) (i) A clash occurs when the hashing algorithm gives the same address *[1 mark]* for more than one record *[1 mark]*
- (ii) Any key field that ends in 001 for example, 12001 *[1 mark]*
- (iii) Any good strategy *[1 mark]* explained with reference to HASH *[1 mark]*. *Accept only two strategies.*
For example:
- increase the number of rows and send clashes to the extra space
 - create an overflow array and send overflows there
 - create a list of pointers giving overflow address for each row *[max 4 marks]*
- (c) *[1 mark]* for each of the following points *[max 4 marks]*
- generate address by hashing algorithm
 - go to head node
 - follow pointers until address found
 - insert address
 - adjust pointer of previous address to point to new one
 - give pointer to next address
- (d) *Give [1 mark] for advantage and [1 mark] for explanation.*
Takes less storage since array could have many empty spaces that are never used.
Do not accept faster.

4. (a) **[1 mark]** for appropriate task and **[1 mark]** for brief description.

For example:

- serves input and output devices
- loads software into memory when requested
- organises storage of program and data files in memory
- controls access to secondary storage
- handles interrupts from peripherals and other sources

- (b) (i) **[1 mark]** for each of the following points **[max 3 marks]**
- Virtual memory is the use of secondary storage
 - as if it were part of primary storage.
 - Part of the data normally held in RAM is actually stored on, for example, disk
 - addressed in the same way as RAM but with paging.
- (ii) **[1 mark]** for stating an advantage and **[1 mark]** for brief description. **[1 mark]** for stating a disadvantage and **[1 mark]** for brief description.
- simpler to run larger programs
 - and more complicated operating systems
 - which cannot be held in primary memory
 - slower than using only primary storage since addressing is more complicated
 - transfer speed from disk slow compared with RAM

5. (a) *Accept any reasonable. Most likely is fibre optic [max 1 mark]*
- (b) *Accept [1 mark] for each of following [max 4 marks]*
- request sent to server with IP address of work station
 - student logged on with own user name file area accessed on server
 - permission on file checked with username
 - if correct file sent to workstation
- (c) *Accept [1 mark] for each of following [max 3 marks]*
- by issuing each user with username
 - maintaining security of passwords
 - setting permissions on files on the server
- (d) *Allow [1 mark] for each of the following points [max 3 marks]*
- part of data from disk on server transferred to memory and sent to workstation
 - either when buffer full or on interrupt
 - brochure data sent to printer buffer
 - process repeated giving impression that the two are happening at the same time
 - in fact each task gets a short burst of time until finished
- (e) **Advantages:** *[1 mark] for each*
- tidier with fewer wires
 - less chance of breakdown
- Disadvantages:** *[1 mark] for each*
- very costly to install
 - if there is breakdown more costly to repair?
 - Infrared is directional. Difficult to get them all to have access to hub.

Only accept **two** advantages and **two** disadvantages *[max 4 marks]*
