

MARKSCHEME

November 2000

COMPUTER SCIENCE

Standard Level

Paper 2

1. (a) One solution is:

```
procedure DISPLAY(val NAME string)
  declare LOCATION integer

  LOCATION <-- SEQUENTIAL(NAME)
  if LOCATION = -1 then
    output "Error - name does not exist"
  else
    output "Book Details"
    output AUTHOR[LOCATION], TITLE[LOCATION], CODE[LOCATION]
  endif
endprocedure DISPLAY
```

(Award marks as follows:)

- [2 marks] for correct **if** statement (candidate may have used #-1 and reversed actions) ([1 mark] for a minor error);
- [1 mark] for any error message in the correct place;
- [2 marks] for correct output of at least two arrays ([1 mark] if only output one array, e.g. AUTHOR).

- (b) Two solutions are:

```
procedure ALL(val LOCATION integer)
  LOCATION <-- LOCATION + 1
  while (LOCATION <= 5168) and (AUTHOR[LOCATION] = AUTHOR[LOCATION - 1]) do
    output AUTHOR[LOCATION], TITLE[LOCATION], CODE[LOCATION]
    LOCATION <-- LOCATION + 1
  endwhile
endprocedure ALL
```

OR

```
procedure ALL(val LOCATION integer)
  if (LOCATION <= 5168) and (AUTHOR[LOCATION + 1] = AUTHOR[LOCATION]) then
    repeat
      LOCATION <-- LOCATION + 1
      output AUTHOR[LOCATION], TITLE[LOCATION], CODE[LOCATION]
    until (LOCATION > 5168) or (AUTHOR[LOCATION + 1] # AUTHOR[LOCATION])
  endif
endprocedure ALL
```

N.B: allow the use of NAME instead of AUTHOR[LOCATION] etc.

Award marks as follows:

- [1 mark] for incrementing LOCATION by 1 before any display (i.e. not repeating previous output);
- [2 marks] for a correct loop to display any details by the correct author;
- [1 mark] for an attempt not to go beyond the end of the array (i.e. subscript 5168 or CODE # 0001290, but not AUTHOR # Zykoni).

(c) (Award [1 mark] for a valid point as indicated below, up to a maximum of [3 marks]:)

- The binary search starts from the middle of the array;
- then keeps reducing the search list by half;
- so it is by calculation that a subscript is used;
- not from start to end;
- so it's just as likely that any of the range is generated.

```
(d) function BINARY(val NAME string)  
    declare MID, LOW, HIGH integer  
    declare FOUND boolean  
  
    FOUND <-- false  
    LOW <-- 1  
    HIGH <-- 5168  
    while (HIGH >= LOW) and (not FOUND) do  
        MID <-- (LOW+HIGH) div 2  
        if NAME = AUTHOR[MID] then  
            FOUND <-- TRUE  
            BINARY <-- MID  
        else  
            if NAME >= AUTHOR[MID] then  
                HIGH <-- MID-1  
            else  
                LOW <-- MID+1  
            endif  
        endif  
    endwhile  
    if not FOUND then  
        BINARY <-- -1  
    endfunction BINARY
```

(Award marks as follows:)

- [3 marks] for a correct loop
 - [1 mark] for terminating when HIGH **>=** LOW
 - [1 mark] for terminating when FOUND
 - [1 mark] for correctly calculating MID in loop
- [2 marks] for testing if found
 - [1 mark] for correct test *i.e.* NAME = AUTHOR[MID]
 - [1 mark] for returning MID through BINARY
- [3 marks] for recalculating MID
 - [1 mark] for test *i.e.* NAME **>=** (or **<=**) AUTHOR[MID]
 - [1 mark] for reassigning HIGH to MID-1 (accept MID)
 - [1 mark] for reassigning LOW
- [1 mark] for returning -1 if required

(e) One method is:

- the binary search function is applied;
- (if the name is in the array) the details at that location are output;
- a search is carried out (towards the start of the array) to find the first occurrence of NAME;
- then procedure ALL is called.

(Award [1 mark] for each of the above points to [4 marks].)

There are variations, such as using ALL once the name is found, searching for the first occurrence, and displaying details until the original location is reached; or “oscillating” around the original location by using LOCATION ± POS, and incrementing POS until NAME is not found in either direction; search sequentially backwards from the point until name changes then search sequentially forwards from the point.

The candidate may have given this in pseudocode, allocate [1 mark] for each of the points above, to [4 marks].

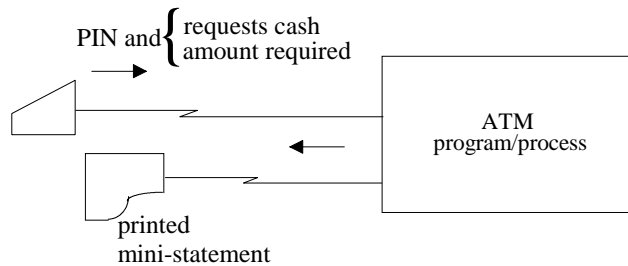
(f) (i) [2 marks] for a clear understanding, [1 mark] for a vague answer. AUTHOR and TITLE need to be swapped throughout the algorithm, (because order is unimportant for a sequential search).

(ii) *(Award [1 mark] for each of the following points up to a max of [3 marks].)*

- The data needs to be sorted on TITLE
- parallel arrays must be maintained
- so all parallel elements / arrays must be swapped as required
- then use binary search on TITLE.

2. (a) (i) – Faster to read off card (than read from central database) **[1 mark]**
– or could be used if link to central computer is down **[1 mark]**
- (ii) *Award marks as follows:*
read from magnetic stripe **[1 mark]**
decrypted (by software) **[1 mark]**
compared with user input (at keypad) **[1 mark]**
- (do NOT accept “compared with PIN in central database”.)
- (b) *(Award marks as below, up to [2 marks] max:)*
easier to use a GUI because:
– just select from menus/options **[1 mark]**
– without having to remember commands **[1 mark]**
– quicker to select than type **[1 mark]**
- (c) *(Award [1 mark] for each point below up to [2 marks] max:)*
– may think his/her job is going to be lost
– may not trust process is fair/*i.e.* “it’s going to happen anyway”/may not feel s/he has any influence
– if s/he reacts negatively, may fear getting the sack.
- (d) more/larger/bigger storage space (do not accept “because it’s bigger”) **[1 mark]**
- (e) *(Award [1 mark] for a valid reason and [1 mark] for a suitable elaboration for two reasons up to a max of [4 marks]:)*
– fear of security, **[1 mark]** *e.g.* bank staff may accidentally see medical details **[1 mark]**
– if reader of paramedics breaks down **[1 mark]** can’t find information because not human-readable **[1 mark]**
– can’t see data **[1 mark]** so there might be a mistake **[1 mark]**
– with all data on 1 card **[1 mark]** if lose it, lose loads of information **[1 mark]**.

(f) (Award marks as follows:)



- [1 mark] for indicating telecoms link either stated or ()
- [2 marks] for user data entry ([1 mark] for PIN and [1 mark] for either request or amount)
- [1 mark] for central program/process
- [1 mark] for output of mini-statement (allow link to be from central process or from user “terminal”, if a two-way arrow is shown on link from terminal to/from process).

(g) (Award marks as follows up to [5 marks] max:)

ATM

- (i) - not important just inconvenient [1 mark]
- other ATMs available [1 mark]
- not “threaten” overall bank [1 mark]

Mainframe

- (ii) - very important [1 mark]
- could severely disrupt bank’s operation [1 mark]
- data could be sent to other mainframe [1 mark]
- but probably too much for it to cope with all operations [1 mark]
- so services disrupted/suspended.

(h) (Accept any of the situations below:) ([2 marks] max)

- using the heat sensor [1 mark] to test if finger belongs to a living person [1 mark]
- fingerprint sensor at ATM [1 mark] to read fingerprint [1 mark]
- using iris camera [1 mark] to read “eye-print” [1 mark]

3. (a) (Award **[1 mark]** for a valid security measure, and **[1 mark]** for a suitable elaboration:)
- User-id **[1 mark]** will identify each user, and managers' ids will allow changes to credit levels **[1 mark]**. (This is using levels of hierarchy.);
 - A physical key/swipe card **[1 mark]** may be required before a credit change which is only issued to managers **[1 mark]**;
 - Credit changes may be restricted to one (or a few) specific terminals **[1 mark]** which may be located in manager-only areas **[1 mark]**;
 - A specific credit change password may be used **[1 mark]** that is only given to managers (and changed regularly) **[1 mark]**.
- (b) (Award **[1 mark]** for identifying a specific area which is important, and **[2 marks]** for a good description of the importance of integrity (**[1 mark]** for a partial answer):)
- Credit limit wrong **[1 mark]** then a suitable customer may be refused an order **[1 mark]** which would annoy the customer and reflect badly on the company/may stop future orders/put off the customer's friends **[1 mark]**;
 - Credit limit wrong **[1 mark]** then an unsuitable customer may be sent an order which s/he can't pay **[1 mark]** and so the company loses money/wastes time having to pursue the matter **[1 mark]**;
 - Address wrong **[1 mark]** which means that an order will be sent to the wrong house **[1 mark]** which would annoy the customer and reflect badly on the company/may stop future orders/lose money on lost goods **[1 mark]**.
- (c) (i) Accept any topology (star, bus or ring) for **[1 mark]**, but only give this mark if it matches the description that follows for a further **[2 marks]** giving **[3 marks]** maximum.
- Star: **[1 mark]** a central server **[1 mark]** from which every workstation/terminal is connected. **[1 mark]**
- Bus: **[1 mark]** a central cable **[1 mark]** off which the server and workstations/terminals are connected. **[1 mark]**
- Ring: **[1 mark]** a continuous circuit of cable **[1 mark]** off which the server and workstations/terminals are connected. **[1 mark]**
- The **[2 marks]** for the description can be gained from an accurate labelled diagram.

(c) (ii) Award [**1 mark**] for each point below, up to a max of [**3 marks**].

- it depends where the cable failure is;
- if it is on the link cable from the LAN to the PC, then only that PC cannot use the LAN;
- if it is the LAN cable then no data can be passed from server to PC.

(Give a second mark if candidate discusses the impact of failure on the main LAN further, e.g. on a bus, PCs up to the failure may be able to access data etc.)

For star topology give the third mark if it is made clear that the rest of the network still works. Note the first point can be awarded if it is clear by implication, so if points two and three are made clearly, the first point is obviously made.

(d) Award marks as follows:

- [**1 mark**] for a specific function and [**1 mark**] for a reason why an operator could not be allowed to use it. × 2 to [**4 marks**] max:
 - delete [**1 mark**] an operator could accidentally / deliberately delete the stock file so no one else could use it [**1 mark**];
 - format [**1 mark**] if an operator formats the disc with the stock file on, it would be ‘lost’ [**1 mark**]
 - copy [**1 mark**] if an operator copies the stock file other may use wrong version [**1 mark**]
 - rename [**1 mark**] if an operator renames the stock file, others may not be able to ‘find’ it [**1 mark**]
-