BOARD OF STUDIES
NEW SOUTH WALES

HIGHER SCHOOL CERTIFICATE EXAMINATION

1999
COMPUTING STUDIES
3 UNIT (ADDITIONAL)

Time allowed—One hour and a half
(Plus 5 minutes reading time)

DIRECTIONS TO CANDIDATES

- No calculators are to be used.

Section I (20 marks)

- Attempt ALL questions.
- Write your Student Number and Centre Number on the Answer Sheet provided.
- Complete your answers in either blue or black pen on the Answer Sheet provided.

Section II (30 marks)

- Attempt BOTH questions.
- Answer each question in a SEPARATE Writing Booklet.

SECTION I

(20 Marks)

Attempt ALL questions.

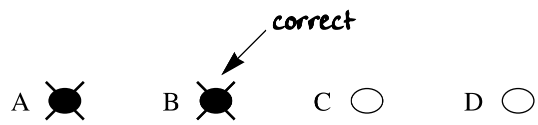
Instructions for answering multiple-choice questions

- Complete your answers in either blue or black pen.
- Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

Sample: 2 + 4 = (A) 2 (B) 6 (C) 8 (D) 9

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

If you change your mind and have crossed out what you consider to be the correct answer, then indicate the correct answer by writing the word *correct* and drawing an arrow as follows.



1

```
PROCEDURE SQUARE
    REPEAT 4 [FORWARD 70 RIGHT 90]
```

The above code is an example of

(A) machine language.

(B) assembler language.

(C) declarative language.

(D) procedural language.

2 A program translates one line at a time of the high-level source code into a low-level object code. The computer executes each line before the next line is translated. This program is

(A) a compiler.

(B) a converter.

(C) an interpreter.

(D) an incremental compiler.

3

```
QUESTION "ARE YOU MARRIED? (YES OR NO)"
    READ ANSWER
    IF ANSWER = "YES" THEN
    MARRIED = TRUE
    END IF
```

The best data structure for the variable MARRIED is

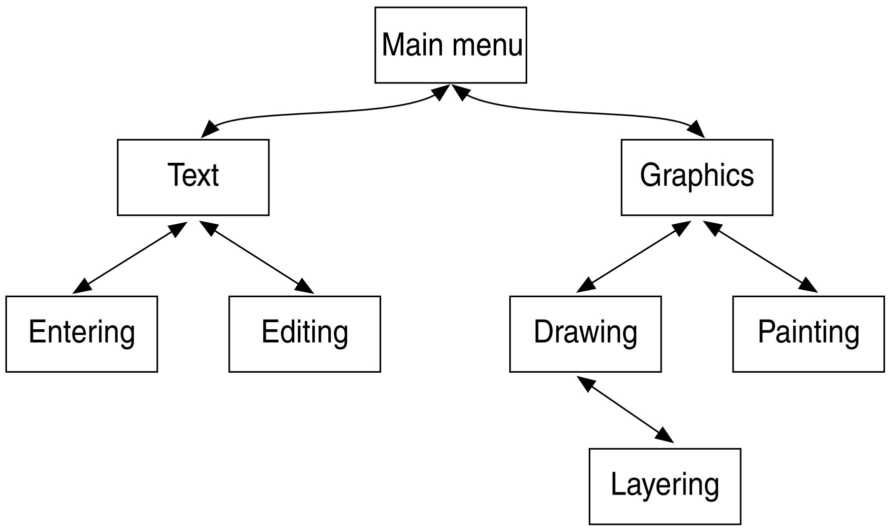
(A) Boolean.

(B) an array.

(C) an integer.

(D) a record.

4



The illustration above is an example of a

(A) storyboard.

(B) procedure chart.

(C) structure diagram.

(D) data flow diagram.

5 During the development of a program the following code was included:

```
SUBROUTINE START_COMMS (LINE_NO, CONNECT_FLAG).
        PRINT "SUB START_COMMS ENTERED"
RETURN
```

This is an example of the use of

(A) stubs.

(B) flags.

(C) boundary testing.

(D) run-time checking.

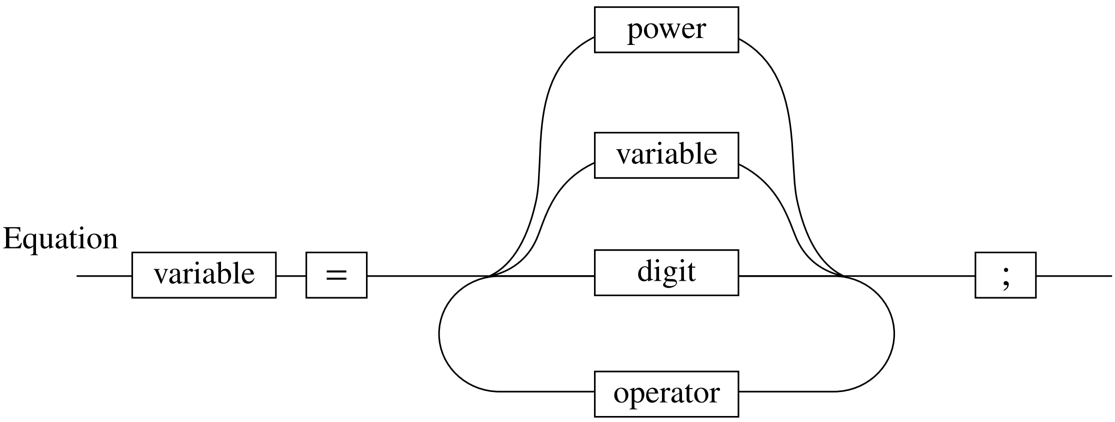
6 The following four EBNF rules and the railroad diagram completely describe the syntax of a computer language.

digit = 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9

variable = x | y | z

operator = + | – | / | *

power = <variable> ^ {<digit>}



Which of the following equations is a valid expression in that language?

(A) $xy = 5;$

(B) $x = 5 * y$

(C) $z = 2 * x * y / z + y \hat{} 2 + x\, y \hat{} 3;$

(D) $y = 2 * x \hat{} 2 + 3 * x - 2;$

7 The following sentence can be considered as a 2-dimensional array of characters:

```
A = I ∇ s h o t ∇ a n ∇ a r r o w
    ∇ i n ∇ t h e ∇ a i r , ∇ ∇ ∇
    ∇ a n d ∇ w h e r e ∇ ∇ ∇ ∇ ∇
    ∇ i t ∇ f e l l ∇ I ∇ ∇ ∇ ∇ ∇
    k n o w ∇ n o t ∇ ∇ ∇ ∇ ∇ ∇ ∇
    w h e r e • ∇ ∇ ∇ ∇ ∇ ∇ ∇ ∇ ∇
```

A[4,10]=I

Which of the following correctly represents the expression

A[2,3] A[1,6] A[5,5] A[6,6] A[6,2] A[3,2] ?

(A) a w ∇ • h n

(B) n t ∇ • h a

(C) n r e h f ∇

(D) a h ∇ e a l

8 A string, S, has been assigned the following characters:

a b c d •

A table for the characters of string S is given below.

Character	Value
•	46
a	61
b	62
c	63
d	64

Using the following algorithm:

```
BEGIN
        Set Sum to zero
        Set A to value of 'a'
        Set Count to 1
        REPEAT
             Set Sum to Sum + A
             Set A to value of S[count]
             Set Count to Count + 1
        UNTIL A<47
END
```

the variable Sum will have the value

(A) 250

(B) 296

(C) 311

(D) 357

9 Detecting, locating and correcting logic syntax errors in a program is called

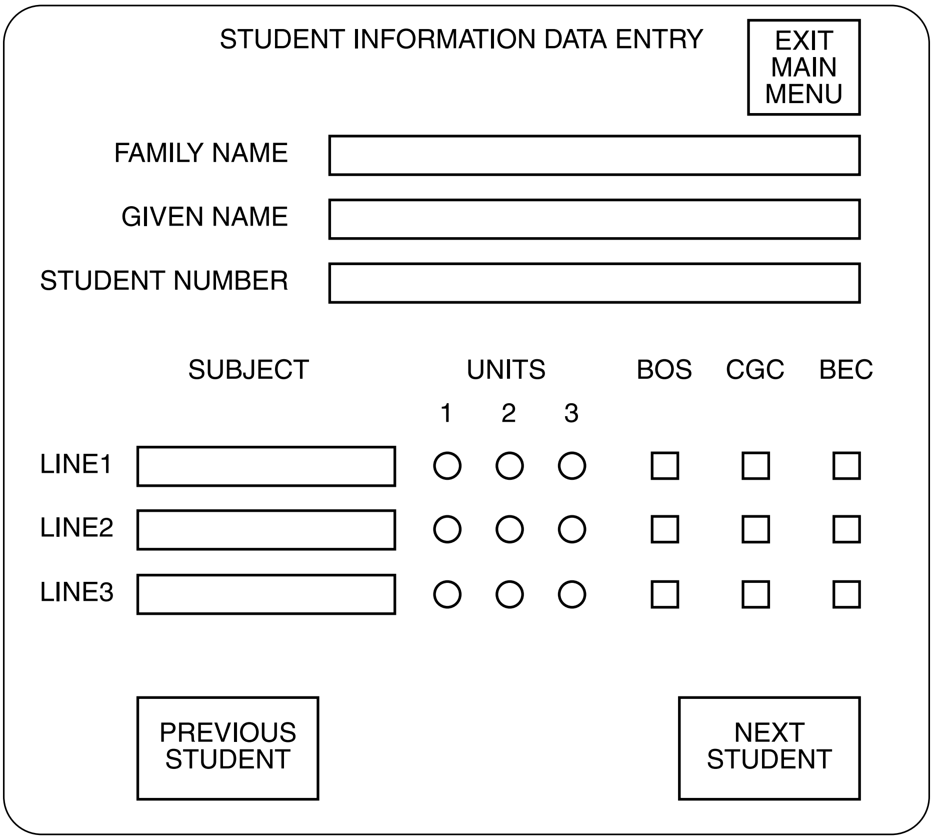
(A) debugging.

(B) maintaining.

(C) pre-processing.

(D) desk checking.

10



The data entry screen above has the following entry elements:

(A) prompts, text boxes, graphics.

(B) icons, menu bars, radio buttons.

(C) menus, radio buttons, choice boxes.

(D) radio buttons, choice boxes, navigational elements.

11 The following information is required by a medical testing laboratory to examine athletes' blood for traces of banned substances.

1	Name	5	Product A amount
2	Age	6	Product B amount
3	Sex	7	Product C amount
4	Event	8	Product D amount

To store the data in a computer system the most suitable data structure would be a

(A) file list.

(B) data schema.

(C) file of records.

(D) data dictionary.

12 Validating data involves a

(A) check by the computer that the data conforms to set rules.

(B) check by the user to ensure data has been entered correctly.

(C) desk check to ensure data conforms to the boundary conditions.

(D) check by the computer that all possible statements are executed and the solution provided is correct in all cases.

13 A problem that can be encountered when using the real data structure for calculations involving large numbers is that

(A) rounding-off errors can occur.

(B) it is difficult to create suitable test data.

(C) only numbers in the range –32767 to +32768 can be used.

(D) the data structure expands to fill the memory space available.

14 User documentation usually contains

(A) technical guidelines.

(B) details of the data structures used.

(C) an explanation of how the program works.

(D) data flow diagrams to assist users.

15 Prototypes are used to

(A) check errors.

(B) validate data.

(C) ensure proper program structure.

(D) sequence the screens in logical order.

16 A programmer compiles a program and runs it using test data. The program terminates unexpectedly, giving the display

```
division by zero undefined
```

This is an example of a

(A) syntax error.

(B) run-time error.

(C) Boolean error.

(D) structural error.

17 The array NAME contains 60 elements, NAME [1] to NAME [60] of type string. Which one of the following algorithms will place the string "Barney" into every element of the array?

(A)
```
BEGIN
   Set Count to 1
   WHILE Count < 60
      NAME [Count] = "Barney"
      Count = Count + 1
   ENDWHILE
END
```

(B)
```
BEGIN
   Set Count to 0
   WHILE Count < 60
      NAME [Count + 1] = "Barney"
      Count = Count + 1
   ENDWHILE
END
```

(C)
```
BEGIN
   Set Count to 0
   REPEAT
      NAME [Count] = "Barney"
      Count = Count + 1
   UNTIL Count < 60
END
```

(D)
```
BEGIN
   Set Count to 1
   REPEAT
      NAME [Count + 1] = "Barney"
      Count = Count + 1
   UNTIL Count < 60
END
```

18

$$A = \begin{bmatrix} a & b & c & d \\ e & f & g & h \\ i & j & k & l \\ m & n & o & p \end{bmatrix}$$

Using the following algorithm with the array A:

```
BEGIN MAIN PROGRAM
INITIALISATION
Set Count to 1
Set Row to 1
    REPEAT
        Col = Count
        REPEAT
            Col = Col + 1
            temp = A[Row] [Col]
            A[Row] [Col] = A[Col] [Row]
            A[Col] [Row] = Temp
        UNTIL Col = 4
        Row = Row + 1
        Count = Count + 1
    UNTIL Row = 3
END MAIN PROGRAM
```

which of the following resulting arrays is correct?

(A) $\begin{bmatrix} a & b & c & d \\ e & f & g & h \\ i & j & k & l \\ m & n & o & p \end{bmatrix}$

(B) $\begin{bmatrix} p & l & h & d \\ o & k & g & c \\ n & j & f & b \\ m & i & e & a \end{bmatrix}$

(C) $\begin{bmatrix} a & e & i & m \\ b & f & j & n \\ c & g & k & o \\ d & h & l & p \end{bmatrix}$

(D) $\begin{bmatrix} k & d & b & o \\ e & h & f & l \\ a & i & n & p \\ j & g & m & c \end{bmatrix}$

19 What documentation would a programmer, employed on a Y2K code maintenance project, find most useful?

(A) Coding features, installation guide, and extrinsic documentation

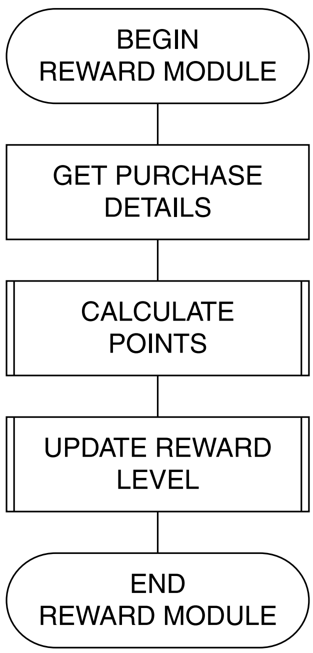
(B) Screen specification, subprogram operation, and user guide

(C) Coding features, functions of the program, and operations of subprograms

(D) Functions of the program, extrinsic documentation and user guide.

20 In a buyer rewards scheme, customers accumulate points each time they purchase goods. There are four levels of rewards: Bronze, Silver, Gold and Platinum, depending upon the number of accumulated points.

The algorithm below is used to calculate the reward level each time a purchase is made.




```
BEGIN Calculate_points
    retrieve previous total_points
    IF  purchase > $500 THEN
        points = purchase – 100
    ELSE
        points = 100
    ENDIF
    total_points = total_points + points
END Calculate_points

BEGIN update reward_level
    CASE where total_points is
                < 1000 : reward_level  =  Bronze
           1000–2000 : reward_level  =  Silver
           2001–4000 : reward_level  =  Gold
         OTHERWISE : reward_level  =  Platinum
    ENDCASE
END update reward_level
```

A customer who has already accumulated 700 points makes new purchases of $500 and $1300.

Their new reward level will be

(A) Bronze.

(B) Silver.

(C) Gold.

(D) Platinum.

SECTION II

Marks

(30 Marks)

Attempt BOTH questions.

QUESTION 21 Use a SEPARATE Writing Booklet. (15 marks)

(a) A team is developing a new programming language. A number of decisions have to be made about the design and how the source code will be translated into object code. **7**

(i) Describe in detail the difference between source code and object code.

(ii) Name the most appropriate programming paradigm for the translation process. Justify your answer.

(iii) The following diagrams represent two methods of translation.

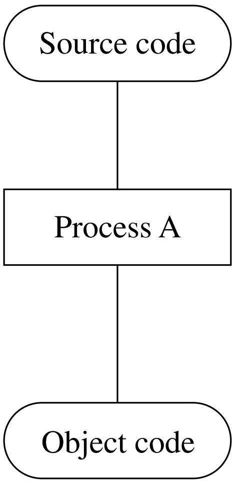


FIGURE 1

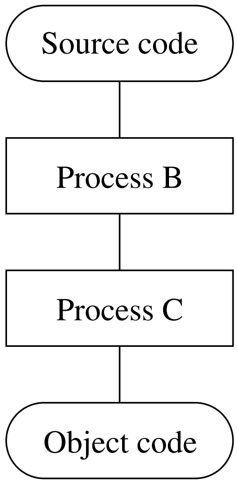


FIGURE 2

1 Name the methods represented by Figure 1 and Figure 2 and describe the advantages of each translation method.

2 For Figure 2, describe what happens in Process B and Process C.

(iv) A translation method produces a permanent object code. Describe in detail the problems that might arise if the object code is run on a number of different computer platforms.

QUESTION 21 (Continued) **Marks**

(b) (i) A variable name in a programming language has the following structure. **8**

- Must commence with an alphabetic character.
- Can only contain alphabetic characters, numeric digits and underscore.
- Can contain an ampersand (&) as the last character of the variable name.

Describe this syntax using EBNF notation.

(ii) Draw a railroad diagram to describe the syntax of the following assignment statement in a new language.

< variable > < =>[<(>]<variable><operator><variable>[<)>]
{<operator><(><variable><operator><variable><)>}<;>

(iii) Name and describe in detail THREE techniques that could be used to check the correct operation of a program, or subprogram.

Please turn over

BLANK PAGE

QUESTION 22 Use a SEPARATE Writing Booklet. (15 marks) **Marks**

(a) The State Electoral Commission has decided to develop a computer-based voting system based on the following scenario. **7**

- All eligible voters eighteen years and older will receive a unique IDENTIFYING NUMBER by mail from the Electoral Commission.
- Voters will go to polling booths at their local school to vote.
- Computer terminals connected to a wide area network will be used at the polling booths.
- Voters will have to enter their IDENTIFYING NUMBER into the system in order to vote, and their name and date of birth will be displayed for confirmation.
- Voters will have to vote for both the Legislative Assembly and Legislative Council.
- Voters will input the number 1 against their preferred candidate.
- Voters will be requested to check their selections and make any changes if necessary before they are logged out of the system.
- A receipt will be given to each voter, indicating the time, date and place of voting.

(i) Create a design prototype for the voting system which shows:

1 input screens;

2 output screens;

3 output reports.

Ensure that the screens show elements of good layout and are sequenced in a logical order.

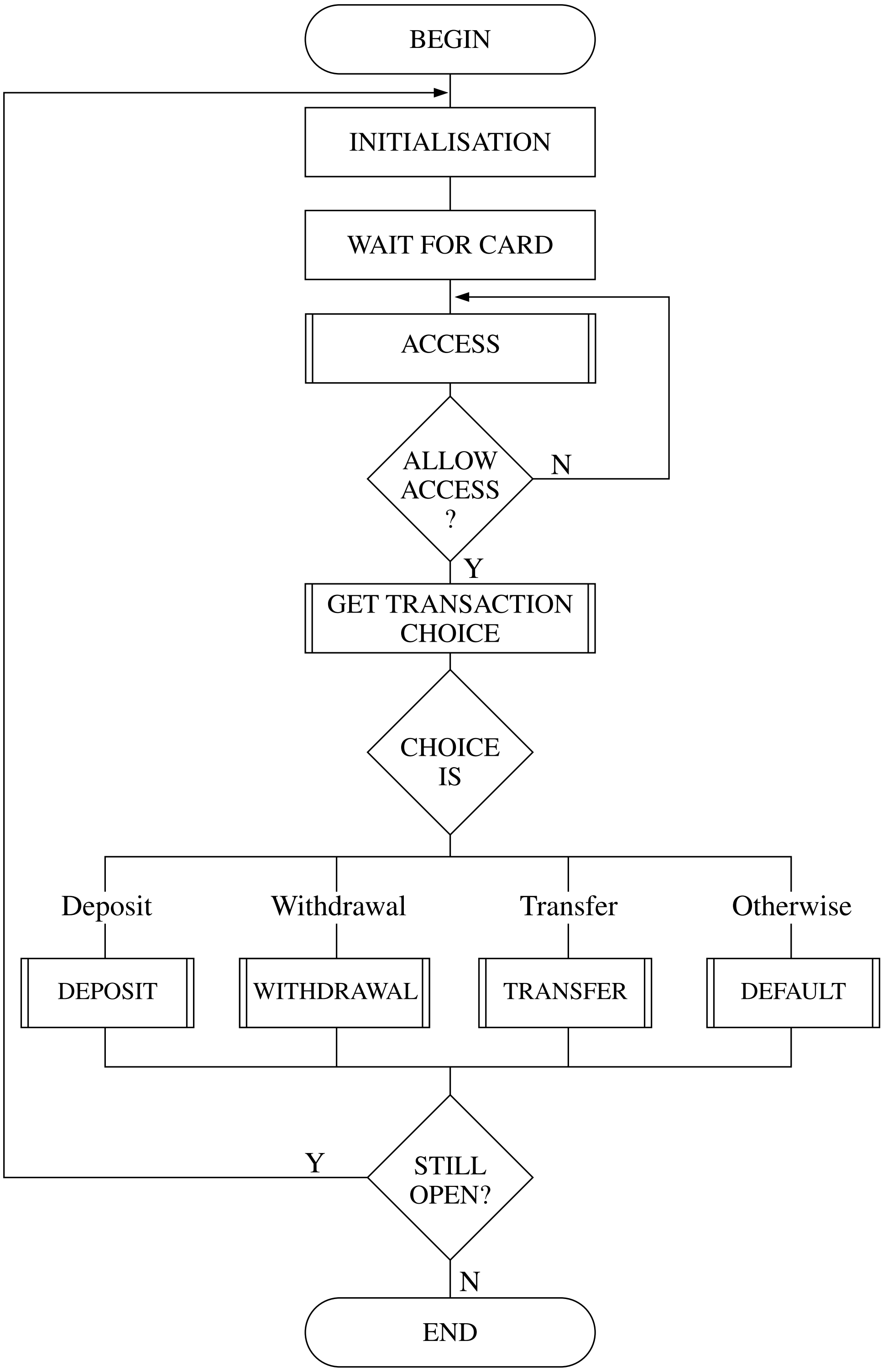
(ii) Justify the use of a prototype by the Electoral Commission.

(iii) What is pre-processing? Give TWO examples using the above scenario.

(iv) There are approximately three million voters who are eligible to vote. Describe the nature and size of the data structure that would be necessary to store the identification numbers and other details of each voter.

QUESTION 22 (Continued) **Marks**

(b) The mainline of a program for an automatic teller machine (ATM) is shown in the following flowchart. **8**



Question 22 continues on page 17

QUESTION 22 (Continued) **Marks**

The following algorithm ACCESS is to be used for an automatic teller machine (ATM).

```
ACCESS MODULE
BEGIN ACCESS
   get account number from access card
   read correct PIN from customer's account file
   get PIN from customer {first try}
   IF PIN ≠ Correct PIN THEN
      display "INCORRECT PIN" on screen, ask customer to re-enter
      get PIN from customer {second try}
      IF PIN ≠ Correct PIN THEN
         display "INCORRECT PIN" on screen, ask customer to re-enter
         get PIN from customer {third try}
         IF PIN ≠ Correct PIN THEN
            DISPLAY "MAXIMUM PIN tries"
            retain access card
         ELSE
            ALLOW ACCESS
            display next question
         ENDIF
      ELSE
         ALLOW ACCESS
         display next question
      ENDIF
   ELSE
      ALLOW ACCESS
      display next question
   ENDIF
END ACCESS
```

(i) Copy the *Last message displayed* column into your Writing Booklet. Desk check the algorithm and write in the last message displayed for the following set of inputs:

PIN first try	*PIN second try*	*PIN third try*	*Last message displayed*	
Correct			1	
Incorrect			2	
Incorrect	Incorrect	Correct	3	
Incorrect	Incorrect	Incorrect	4	

Question 22 continues on page 18

QUESTION 22 (Continued) **Marks**

(ii) Using pseudocode OR a flowchart, write an algorithm for the WITHDRAWAL module that allows withdrawals from the ATM satisfying the following requirements:

- Each customer can withdraw up to $500 per day from each account.
- The minimum withdrawal amount for each transaction is $20.
- Withdrawals cannot exceed the amount in the customer's account.

(iii) Write out a suitable set of test data and desk check your algorithm for a customer whose account balance is $700.

(iv) Using pseudocode OR a flowchart, write an algorithm that allows transfers between customer accounts satisfying these requirements:

1 Each customer is allowed to use only accounts that he/she currently has with the bank.

2 The transfer amount must be at least $50 and not more than $1000 but must not exceed the amount in the customer's account.

3 The customer must be allowed to correct his/her mistakes by re-entering the account type and amount.

4 The ATM must ask the customer to verify the amount entered before completing the transaction.

5 The ATM must ask the customer if a receipt of transaction is required and if so, print one at the end of the transaction.

End of paper

BLANK PAGE

BLANK PAGE