



### Question 1

Study the following algorithm.

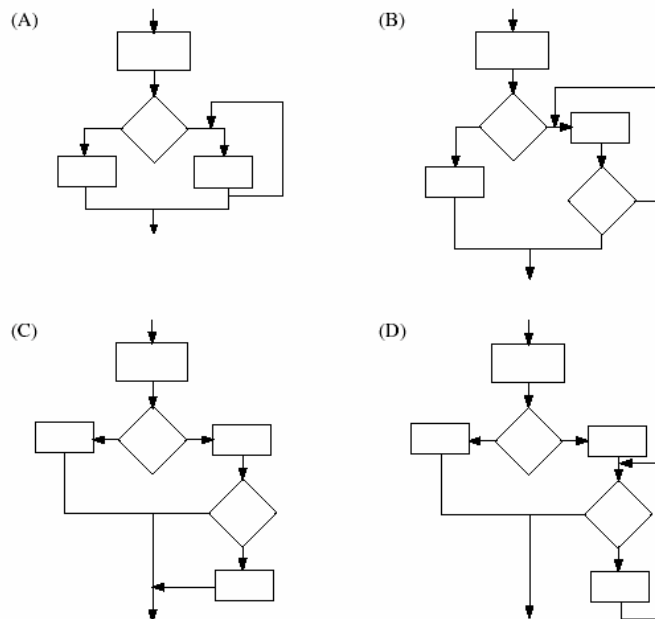
```
BEGIN
    READ A
    READ B
    WHILE A <> 2 AND B <> 2
        PRINT A * B
        READ A
        READ B
    ENDWHILE
END
```

From the input data  
0, 1, 1, 2, 2, 3, 2, 2  
the output produced will be

- (A) 0
- (B) 0, 2
- (C) 0, 2, 6
- (D) 0, 2, 6, 4

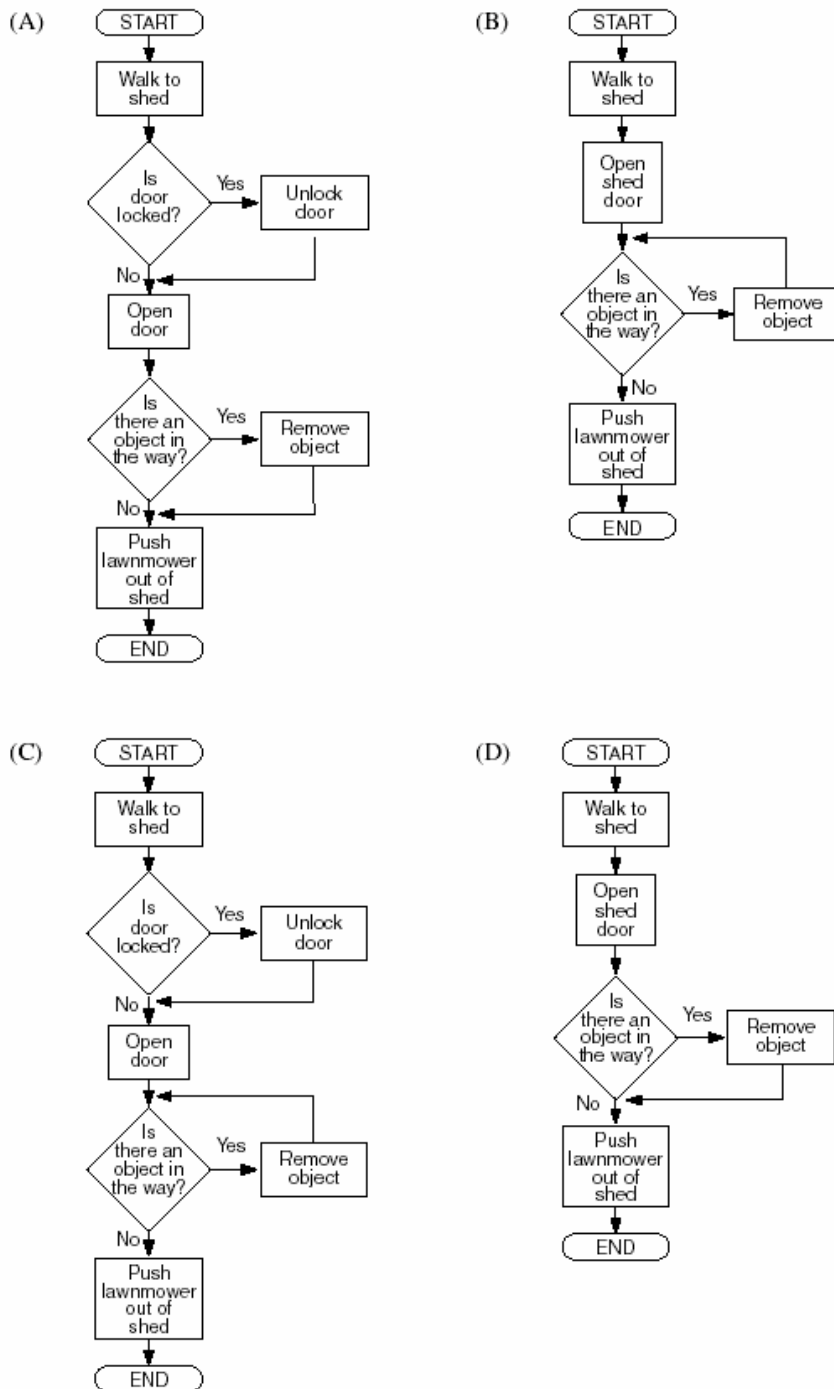
### Question 2:

Which of the following programming structures has a pre-test repetition?



### Question 3

A person wants to use a lawnmower. The person goes to a lockable shed, opens the shed door, removes each object, in turn, that may be in the way and pushes the lawnmower out of the shed. Which of the following algorithms best describes this task?



### Question 4

(a) A security alarm system has been installed at the entrance of a building. The system will only allow entry to people who have keyed in the correct four digit number, using a key pad, within 10 seconds. After entering the number, the user presses an 'ok' button to allow the number to be checked. Only one attempt at entering the four digit number is allowed.

A siren will sound if:

- the number entered is incorrect
- the 10 second time period, allowed for keying in all four digits and pressing the 'ok' button, has elapsed.

(i) Design a minimum set of tests, for the given description, by completing the table.

<i>Time</i>	<i>Number</i>	<i>Expected result</i>
< 10 secs	correct	entry 'ok'

(ii) The algorithm that is designed to operate the system is given below: There is at least ONE error in the above algorithm. Identify the error(s) and explain the impact on the system.

1. BEGIN ALARM
2. set time elapsed to zero
3. set number to not valid
4. WHILE time elapsed < 10 seconds OR number is not valid
5. IF 'OK' key has been pressed THEN
6. READ number from key pad memory
7. IF number is not valid
8. sound siren
9. END IF
10. END IF
11. Update time elapsed
12. ENDWHILE
13. sound siren
14. END ALARM

(iii) The original algorithm for the security alarm system does not allow the user to re-enter the code number if they have accidentally pressed an incorrect key. Rewrite the algorithm, using EITHER a flowchart OR pseudocode, so that

- a 'cancel key' can be used to allow re-entry of the code number, and reset of the timer, within 10 seconds;
- up to three entry tries are allowed.

(b) A sports car has an automated braking system. This braking system automatically corrects the braking pressure when the car is travelling around corners dangerously. Braking pressure will be automatically applied, based on conditions shown in the table.

<i>Turning angle</i>	<i>Speed dry conditions (km/h)</i>	<i>Speed wet conditions (km/h)</i>
> 180°	over 10	over 5
> 90°	over 35	over 20
> 45°	over 50	over 30

Use EITHER a flowchart OR pseudocode to write an algorithm that determines when the braking pressure should be automatically applied as specified.

**Question 5**

Array A = [7, 21, 8, 7, 23, 11, 27]

Array B = [a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, r, s, t, u, v, w, x, y, z]

B [1] = a

Using the data in Array A and Array B, what will be the output of the following algorithm?

```
BEGIN
    FINAL = A [3]
    COUNT = 2
    REPEAT
        DISPLAY B [A [COUNT] - COUNT]
        COUNT = COUNT + 1
    UNTIL COUNT = FINAL
END
```

- (A) select                      (B) second                      (C) secret                      (D) seconds

**Question 6**

The set of numbers 8, 5, 1, 7, 3, 2 was read into the following program:

```
BEGIN
    SET COUNT TO 1
    READ A
    REPEAT
        READ A
        READ B
        WHILE A > 0
            DISPLAY B
            A = A - 1
        ENDWHILE
        COUNT = COUNT + 1
    UNTIL COUNT = 3
END
```

Which of the following is the correct output?

- (A) 1111333333  
 (B) 111113333333  
 (C) 55555557  
 (D) 55555557222

**Question 7**

```
IF TEMP = 35°C THEN
    SET CONDITION TO "HOT"
ELSE
    IF TEMP = 25°C THEN
        SET CONDITION TO "WARM"
    ELSE
        IF TEMP = 20°C THEN
            SET CONDITION TO "NORMAL"
        ELSE
            SET CONDITION TO "COLD"
        ENDIF
    ENDIF
ENDIF
```

How many values would be required to form a minimum set of test data for checking this algorithm?

- (A) 3                      (B) 4                      (C) 5                      (D) 6

**Question 8**

The following diagram shows the contents of an array of records used for mixing colours.  
The name of the array is 'COLOUR'.

	NAME OF COLOUR	REDVALUE	GREENVALUE	BLUEVALUE
1	CHARTREUSE	1	3	1
2	VERMILION	5	3	3
3	TURQUOISE	2	4	7
4	CRIMSON	6	1	2

The algorithm below is used to calculate colour values, using an array.

BEGIN

SET TOTAL TO 0

SET COUNTER TO 1

WHILE COUNTER < 4

TOTAL = TOTAL + COLOUR [COUNTER] . GREENVALUE

ADD 1 TO COUNTER

ENDWHILE

WHILE COUNTER < 4

TOTAL = TOTAL + COLOUR [COUNTER] . REDVALUE

ADD 1 TO COUNTER

ENDWHILE

PRINT TOTAL

END

What will be the output of this algorithm?

(A) 10

(B) 11

(C) 18

(D) 25

**Question 9:**

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

**Question 10:**

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?

- |  |  |
|--|--|
| <p>(A) BEGIN<br/>           Set Count to 1<br/>           WHILE Count &lt; 60<br/>               NAME [Count] = "Barney"<br/>               Count = Count + 1<br/>           ENDWHILE<br/>           END</p> | <p>(B) BEGIN<br/>           Set Count to 0<br/>           WHILE Count &lt; 60<br/>               NAME [Count + 1] = "Barney"<br/>               Count = Count + 1<br/>           ENDWHILE<br/>           END</p> |
| <p>(C) BEGIN<br/>           Set Count to 0<br/>           REPEAT<br/>               NAME [Count] = "Barney"<br/>               Count = Count + 1<br/>           UNTIL Count &lt; 60<br/>           END</p>   | <p>(D) BEGIN<br/>           Set Count to 1<br/>           REPEAT<br/>               NAME [Count + 1] = "Barney"<br/>               Count = Count + 1<br/>           UNTIL Count &lt; 60<br/>           END</p>   |

**Question 11:**

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?

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

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

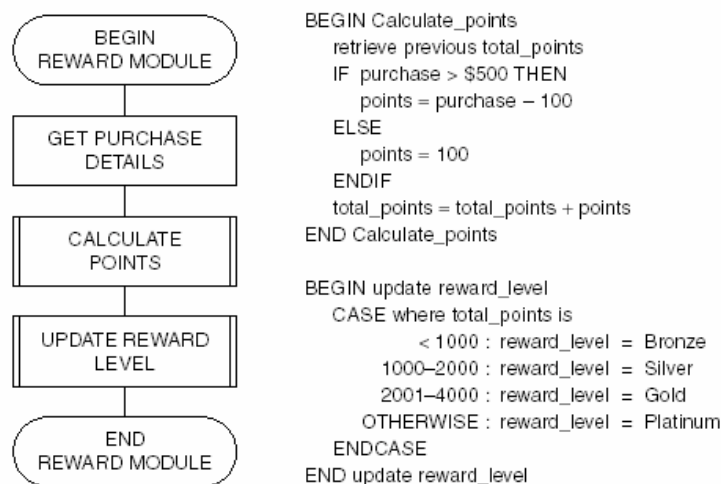
(B) 
$$\begin{bmatrix} p & l & h & d \\ o & k & g & c \\ n & j & f & b \\ m & i & e & a \end{bmatrix}$$

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

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

### Question 12:

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.



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.

### Question 13

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

- 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 14.** The following code segment

BEGIN

Set B to 100

Set A to 1

WHILE A<10

B = B / A

A = A - 1

Print A

ENDWHILE

END

will result in

(A) an infinite loop. (B) a compile-time error. (C) a divide-by-zero error. (D) a circular reference error.

**Question 15.**

The following algorithm initialises an array named 'ALPHA', indexed as ALPHA [ROW, COLUMN].

BEGIN

Set A to 1

REPEAT

Set Y to 1

REPEAT

Set ALPHA [Y, A] to A + 1

Set Y to Y + 1

UNTIL Y > 4

Set A to A + 1

UNTIL A > 4

END

Which of the following arrays will be produced by the algorithm?

(A)    2   3   4   5  
      3   4   5   6  
      4   5   6   7  
      5   6   7   8

(B)    2   2   2   2  
      3   3   3   3  
      4   4   4   4  
      5   5   5   5

(C)    5   6   7   8  
      4   5   6   7  
      3   4   5   6  
      2   3   4   5

(D)    2   3   4   5  
      2   3   4   5  
      2   3   4   5  
      2   3   4   5

**Question 16:**

The array FIDO contains 500 elements, FIDO [1] TO FIDO [500]. Which ONE of the following algorithms will initialise all elements of FIDO to the value of 9?



(A) BEGIN  
 Set Count to 1  
 WHILE Count < 500  
 FIDO [Count] = 9  
 Count = Count + 1  
 ENDWHILE  
 END

(B) BEGIN  
 Set Count to 0  
 WHILE Count < 500  
 FIDO [Count + 1] = 9  
 Count = Count + 1  
 ENDWHILE  
 END

(C) BEGIN  
 Set Count to 1  
 REPEAT  
 FIDO [Count + 1] = 9  
 Count = Count + 1  
 UNTIL Count < 500  
 END

(D) BEGIN  
 Set Count to 0  
 REPEAT  
 FIDO [Count] = 9  
 Count = Count + 1  
 UNTIL Count < 500  
 END

### Question 17

Use this material for Question 17 parts (b) and (c).

A charity organisation conducts adventure holiday camps for young disabled people 18–25 years of age. Participants must choose ONE activity, such as rock climbing or white-water canoeing, during the camp. You are part of a project team working on a new system for camp administration. The system will cover the major areas of camper registration and allocation of campers to selected activities. You have written the camper registration program. The system uses a number of database files, of which only three are of interest to you. These files and the fields relevant to your program

<i>Camper</i>
camper_id
family_name
first_name
home_address
phone_number
date_of_birth
gender

<i>Activities</i>
activity_code
activity_name

<i>Camper activity</i>
camper_id
activity_code

are summarised below.

Part of the data dictionary for the system is shown below:

<i>Field</i>	<i>Type</i>	<i>Size</i>	<i>Example</i>
family_name	Text	20	Brownwith
first_name	Text	20	Jane Gweneth
home_address	Text	40	30 Seventh Avenue, Ganston NSW 2118
phone_number	Numeric	10	0244676989
gender	Text	1	F
date_of_birth	Date		12/10/1980
activity_code	Text	4	ABSL

All fields must have an entry.

(b) (i) Design and draw the entry screen for the camper registration program.

- (ii) Describe the features of good design that you have incorporated into your screen.
- (iii) Describe, using diagrams if necessary, how you would display:
1. general input requirements;
  2. error messages.
- (c) (i) Specify the data validation requirement for each of the following fields:
- family\_name
  - phone\_number
  - gender
  - date\_of\_birth
  - activity\_code.
- (ii) Describe the requirements of good test data for the camper registration system.
- (iii) Full\_name is a combination of the first\_name and family\_name fields. It is used in a program for addressing letters to campers. When the first\_name field contains more than one name, only the first letter of the second name is used, followed by a full stop.
- Example: Jane G. Brownwith
- Describe the program syntax of full\_name using BNF or EBNF or railroad diagrams.

### Question 18.

- (a) HOLD is a ten-element array that is used to store words. It does so with each of

#### EXAMPLE

	1	2	3	4	5	6	7	8	9	10
HOLD	S	L	O	O	P	▽	▽	▽	▽	▽

its elements storing either a letter of the word or the blank character .

- (i) Write an algorithm, using EITHER a flowchart OR pseudocode, that will find the number of non-blank characters in the array HOLD, and store it in a variable called LENGTH.
- (ii) Using a variable called LENGTH that holds the length of the word stored in the array HOLD, write an algorithm that will reverse the order of the characters in HOLD without affecting the blanks. You may use EITHER a flowchart OR pseudocode.

#### EXAMPLE

If the word SLOOP was stored in HOLD, it appears as

	1	2	3	4	5	6	7	8	9	10
HOLD	S	L	O	O	P	▽	▽	▽	▽	▽

When your algorithm is applied, HOLD appears as

	1	2	3	4	5	6	7	8	9	10
HOLD	P	O	O	L	S	▽	▽	▽	▽	▽

- (iii) Write an algorithm using EITHER a flowchart OR pseudocode that will perform an ascending, alphabetical sort on the array HOLD.

- (b) A casualty ward of a hospital wants to install a computerised patient management system. The system will display the name of the next person to see a doctor. The system will store patients' names in the priority order in which they will see a doctor. The system can accommodate up to 50 patients. Patients waiting to see a doctor are classified into one of the following categories:

<i>Category</i>	<i>Description</i>
<i>R</i>	Patients waiting for a check-up
<i>S</i>	Patients who are sick
<i>U</i>	Patients who need urgent attention

The names of the patients are stored in the array NAMES and their categories in the array CATEGORY. Category *S* and *R* patients are treated as having equal priority and will be placed in the queue waiting to see a doctor in the order in which they arrive at the casualty ward. Category *U* patients take precedence over the other patients. Whenever a patient with an emergency classification of *U* arrives at the casualty ward they are given the highest priority available, moving patients of lower priority down the order.

Using flowcharts or pseudocode, write algorithms for the patient management system to:

- list the patients in the order in which they will see a doctor;
- add a new patient to the list of waiting patients, based on their priority;
- delete a patient from the list of waiting patients.

**Question 19:**

Study the following algorithm.

```

READ A
READ B
REPEAT
    SET C TO (A+B)/2
    PRINT C
    READ A
    READ B
UNTIL A = 0

```

The following values are entered in sequence  
4 6 2 0 0 8 3 5.

Which of the following shows the correct output?

- (A) 5                      (B) 51                      (C) 514                      (D) 5144

**Question 20:**

What will be the output produced by the following algorithm if  $A = 1$  and  $B = 2$ ?

```

READ A
READ B
WHILE NOT ((A<=0) AND (B<=0))
    IF A>B THEN
        PRINT 'First'
    ELSE
        IF A<B THEN
            PRINT 'Second'
        ELSE
            PRINT 'Equal'
        ENDIF
    ENDIF
ENDWHILE

```

- (A) First                      (B) Equal                      (C) Second                      (D) no visible output

**Question 21**

- (a) An Internet service provider (ISP) has an on-line access policy that includes the following conditions:
- 1 a customer is restricted to 120 minutes for each on-line session;
  - 2 no more than 20 Mb of download is allowed in each on-line session.

Time is to be logged in minutes, and downloads in whole megabytes. During an on-line session a small message 'access OK' is displayed in a corner of the screen.

Once either of the above conditions has been met, the message changes to 'access terminated' and the customer is automatically logged off.

(i) Design a set of test data that will be needed to desk check the above conditions and show the expected display.

(ii) The algorithm module below was designed to implement the access

<i>Time</i>	<i>Download</i>	<i>Expected display</i>

policy.

BEGIN INTERNET ACCESS CHECK

set time to zero

set download to zero

WHILE time < 120 OR download < 20

update time

update download

IF time < 120 OR download < 20 THEN

display 'ACCESS TERMINATED'

ELSE

display 'ACCESS OK'

END IF

ENDWHILE

END INTERNET ACCESS CHECK

There are errors in the above algorithm.

Identify the line number(s) in which an error occurs and explain the effect of that error.

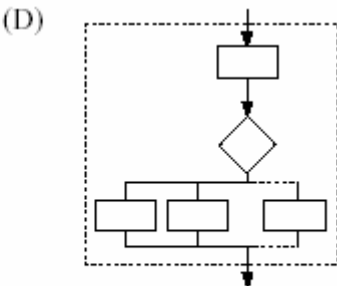
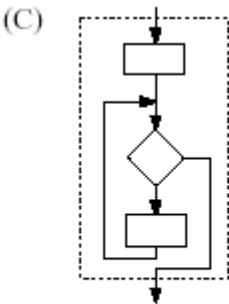
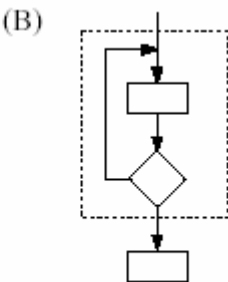
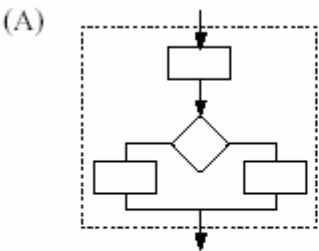
<i>Line no.</i>	<i>Explanation of error</i>

- (iii) Using pseudocode or a flowchart, rewrite the algorithm so that it correctly carries out its intended purpose. Use the space below.
- (iv) In response to complaints from customers, the ISP decides to allow downloads in excess of the 20 Mb limit but intends to charge 10 cents for each Mb downloaded above 20 Mb. Describe a modification that would need to be made to your corrected algorithm in part (a) (iii) to accomplish this change of policy.
- (b) (i) Complete a desk check of the following pseudocode using the data values [2, 3, 7, 5, 1, 6, 999] and a table format of:

<i>L</i>	<i>X</i>	<i>Output</i>

- (ii) What is the purpose of two input statements?
- (iii) Write the pseudocode as a flowchart.

**Question 22.** The flowchart structure that best shows a post-test is

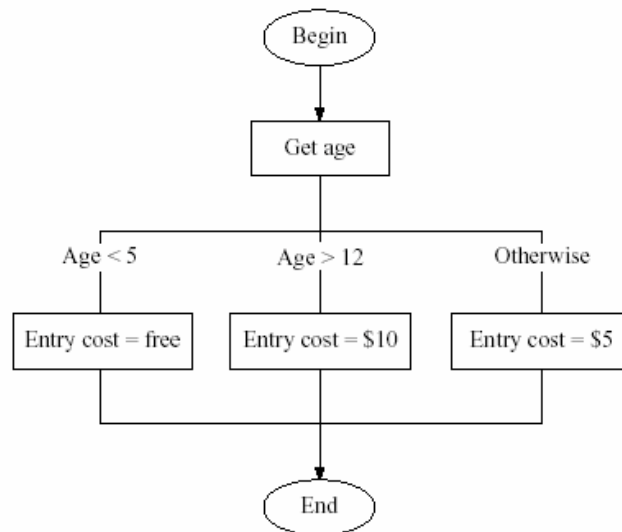


**Question 23:**  
 BEGIN  
     A = 2  
     WHILE A < 7  
         read B  
         set A = A + B  
         print A  
     ENDWHILE

END

If the values available for B in the above algorithm are 1, 3, 1, 1, 5, then the output from the algorithm would be  
(A) 3, 6, 7                      (B) 3, 6, 7, 8                      (C) 2, 3, 6, 7                      (D) 3, 5, 3, 4, 7

**Question 24.** An algorithm to determine the entry fee to an amusement park would be:



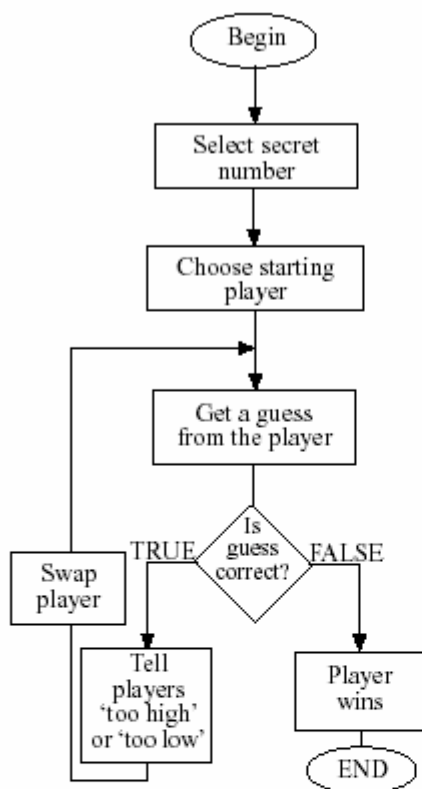
A minimum test set for the algorithm is

- (A) 4, 13                      (B) 4, 5, 13                      (C) 4, 5, 12, 13                      (D) 4, 5, 12, 13, 15

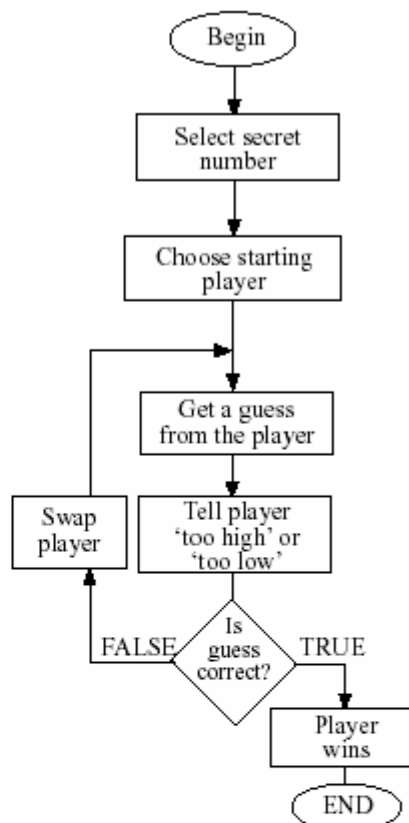
**Question 25.** Two players take turns until they guess a secret number. After each guess the player is told if the guess is too low, too high, or correct.

The algorithm that best illustrates this game is

(A)



(B)



(C) BEGIN

```

choose starting player
select secret number
REPEAT
  get player guess
  CASEWHERE player guess is
    > secret number: tell player 'too low'
                      swap player
    < secret number: tell player 'too high'
                      swap player
  ENDCASE
UNTIL player guess is correct
declare player the winner
END

```

(D) BEGIN

```

choose starting player
select secret number
REPEAT
  get player guess
  CASEWHERE player guess is
    > secret number: tell player 'too high'
                      swap player
    < secret number: tell player 'too low'
                      swap player
  ENDCASE
UNTIL player guess is correct
declare player the winner
END

```

**Question 26.** The process of iteration best represented in pseudocode is

- (A) IF counter < 10 THEN increment counter by 1  
ENDIF
- (B) WHILE counter < 10  
display counter  
increment counter by 1  
ENDWHILE
- (C) CASEWHERE iteration  
required : increment counter by 1  
not required : increment counter by 2  
ENDCASE
- (D) BEGIN SUBPROGRAM  
iteration  
END SUBPROGRAM

**Question 27:**

(a) The *face value* of a card can be 2, 3, 4, 5, 6, 7, 8, 9, 10, Jack, Queen, King, Ace or Joker. A game is played with a deck of cards that contains one Joker. The deck is shuffled and then cards are dealt out one at a time until the Joker is reached. One point is received for each card dealt before the Joker appears. The CARD GAME algorithm below illustrates this process.

(i) Using pseudocode OR a flowchart, modify the CARD GAME algorithm so that it will not print out the face value of the Joker. Indicate the line numbers of all affected statements.

1. BEGIN CARD GAME
2. Shuffle cards
3. Points = 0
4. REPEAT
5. READ card
6. PRINT face value of card
7. Points = Points + 1
8. UNTIL card = Joker
9. PRINT points
10. END CARD GAME

(ii) There is at least one error in the scoring of the CARD GAME algorithm. Describe ONE error and explain how it might be fixed.

(iii) A player's scores for ten turns of the CARD GAME algorithm have been recorded in the array SCORES below. Using EITHER pseudocode OR a flowchart, write an algorithm that will

- read the scores into the array;
- search the array SCORES;
- record the highest score in a variable called HIGH VALUE.

Your algorithm should print the highest score before it ends. 30 24 34 16 20 10 16 4 22 8

(b) A lift has a computer-controlled alarm system and automatic sensors that can detect whether people are in it. The lift is monitored continuously in its operation.

(i) If the lift has a fault and stops between floors, one of two types of alarms is signalled.

Priority 1—if people are in the lift. A recorded message is played 'HELP IS ON THE WAY' and an alarm is sounded.

Priority 2—if no people are in the lift. No message is played but an alarm is sounded.

Using pseudocode OR a flowchart, write an algorithm, in the space below, to show the lift's warning system.

(ii) If a fire occurs in the building, the lift is programmed to stop at the nearest floor. The alarm system plays a recorded message 'FIRE—DO NOT USE LIFT'. When there are no people in the lift, the water sprinkler system is activated.

Using pseudocode OR a flowchart, write an algorithm to show the lift's fire warning system. You must include the consequences for BOTH the fire occurring AND the fire not occurring.