BOARD OF STUDIES
NEW SOUTH WALES

HIGHER SCHOOL CERTIFICATE EXAMINATION

1995

COMPUTING STUDIES

3 UNIT (ADDITIONAL)

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

DIRECTIONS TO CANDIDATES

Section I (20 marks)
- Attempt ALL questions.
- Mark your answers in pencil 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.

Select the alternative A, B, C, or D that best answers the question.

Mark your answers in pencil on the Answer Sheet provided.

1. *Declarative* programming languages are most commonly used in which programming paradigm?

    (A) imperative

    (B) functional

    (C) logic

    (D) object-oriented

2. Which language would be best suited to implementing a solution to a problem in natural-language translation?

    (A) C^{++}

    (B) LISP

    (C) Prolog

    (D) Pascal

3. In a program, which would be the best data structure to represent the maximum and the minimum temperatures for each month in a year?

    (A) A record.

    (B) A file of reals.

    (C) An array of records.

    (D) A two-dimensional array of reals.

4. The elements of the arrays X and Y are shown below.

X	4	3	2	1

Y	3	1	2	4

    The value of $X[4]$ is 1 and both arrays are indexed in the same way. What is the value of $X[Y[2]+1]$?

    (A) 1

    (B) 2

    (C) 3

    (D) 4

5. Given the following syntax definition in some programming language:

    <constant> = 0|2

    <variable> = A|X|E

    <expression> = <variable> [@|?<expression>]?<constant>

    <do-it statement> =<variable>##<expression>

    which of the following is a syntactically correct do-it statement in that language?

    (A) A##@2
    (B) A##E?0
    (C) A##2X@E
    (D) A##E@0?2

6. In the programming statement
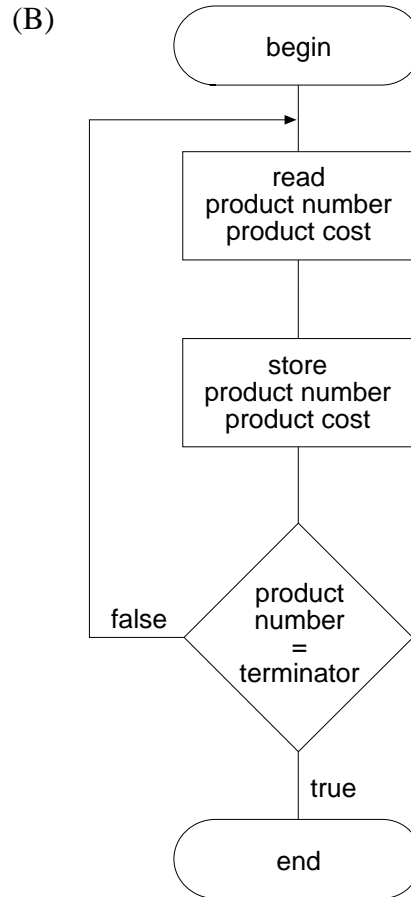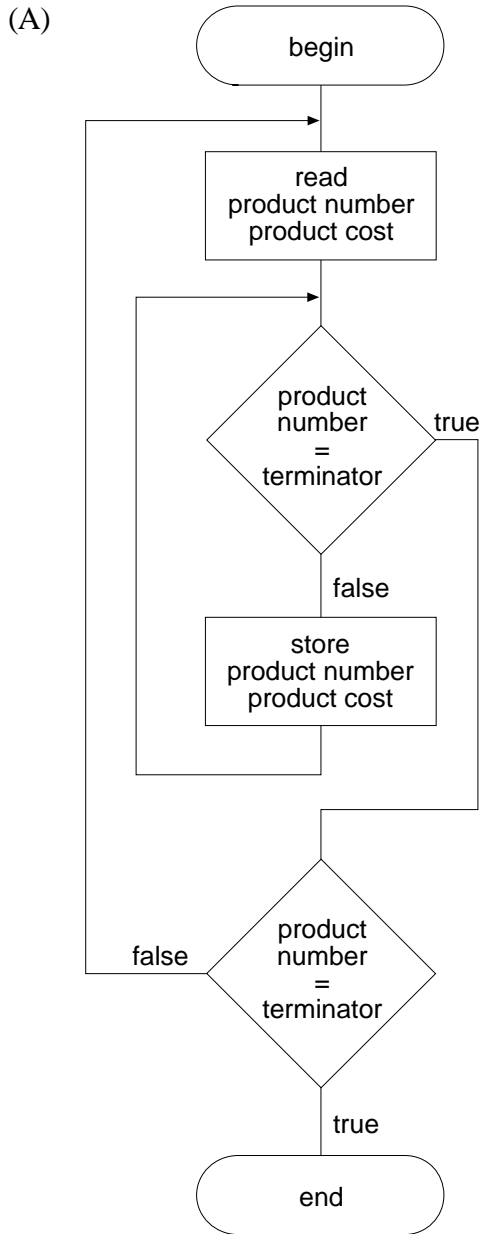
    price := cost + profit

    where ':=' means 'is assigned the value of', which of the following is true?

    (A) 'price', 'cost', and 'profit' are operands, and '+' and ':=' are operators.
    (B) '+' is the only operator.
    (C) 'price' is the operator, and 'cost', '+', and 'profit' are the operands.
    (D) ':=' is an operand.

7. The purpose of a flag is to

    (A) debug a program.
    (B) show which piece of code was executed.
    (C) indicate whether a program worked correctly.
    (D) ensure that initialization is performed at the start of a program.

8. Which of the following statements is true of machine language?

    (A) It must be translated into a high-level language before execution.
    (B) It must be processed by a computer or interpreter before execution.
    (C) It is the only language that can access the registers on a computer.
    (D) It is specific to the CPU of each type of computer.

9. An algorithm is to be written which will read-in sets of two numbers (representing a product number and its cost). The pair is stored in an array. The algorithm stops when the product number last stored matches a terminating value.
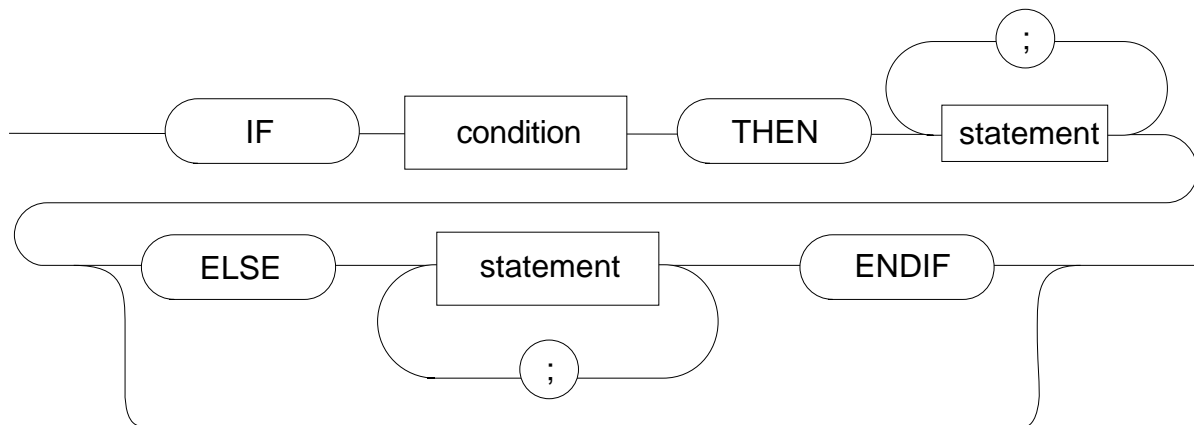
Which of the following is the correct algorithm?

(A)

(B)

(C) BEGIN
    read product number
    read product cost
    WHILE product number ≠ terminator
      store product number
      read product cost
      read product number
      read product cost
    ENDWHILE
END

(D) BEGIN
    REPEAT
      read product number
      store product number
      IF product number ≠ terminator THEN
        read product cost
        store product cost
      ELSE
        read product number
      ENDIF
    UNTIL product number = terminator
END

10. In checking a program, the programmer issues a set of test data which

(A) includes values that will prove the program works for all input.

(B) includes values that will test each path in the program.

(C) tests each path in the program, and includes values representing boundary values.

(D) proves that the program works for the boundary values chosen.

11. In order to show a client that the input and output screens of a program under development meet specifications (without providing detailed error-checking), the programmer would generate

(A) a storyboard.

(B) a prototype.

(C) a data-flow diagram.

(D) an IPO diagram.

12. The syntax of a selection statement in a proposed language is defined by:

Which of the following is a syntactically correct selection statement in that language?

(A) IF condition THEN statement; ELSE statement; ENDIF

(B) IF condition THEN statement; statement; statement

(C) IF condition THEN statement
ELSE statement; statement; statement; ENDIF

(D) IF condition THEN;
        statement;
ELSE;
        statement;
ENDIF

13. A program with a graphical user-interface offers its user the choice of setting a default value for output. The four alternatives are: to the screen, to the printer, to a text file, or to a spreadsheet file. The most appropriate element to present this choice is

(A)   menu bars.

(B)   radio buttons.

(C)   dialogue boxes.

(D)   appropriate control keys.

14. A programmer *should* include a comment in a line of code to explain the

(A)   purpose of that line.

(B)   reason for any un-obvious calculation or test in lines of code.

(C)   type of each variable used in that line.

(D)   condition being tested at that decision point.

15. Object code

(A)   can be produced from high-level languages, but not from assembly language.

(B)   is produced by interpreters, but not compilers.

(C)   is the code that runs when loaded into the computer.

(D)   is written using an object-oriented language.

16. The components of internal documentation include:

(A)   procedure names, comments, and balloon text.

(B)   procedure names, comments, and links to tutorials.

(C)   variable names, balloon text, and links to tutorials.

(D)   variable names, procedure names, and comments.

17. Part of the syntax of a programming language is defined as follows:

<reserved word> = IF | THEN | ELSE | BEGIN | END | REPEAT | UNTIL | WHILE | DO

This means that

(A)   the nine words must appear in the order given.

(B)   the programmer must declare variables using these names to reserve memory space for them.

(C)   the programmer cannot use any of these words as the names of variables.

(D)   the computer will not report a syntax error when any of these words are used.

18. A computer uses 8 bits to represent an integer. The binary pattern 10000000 represents

    (A) –1 in two's complement.

    (B) –0 in one's complement.

    (C) –128 in two's complement.

    (D) –128 in one's complement.

19. A program is executed and the error message 'arithmetic overflow' is displayed. This is an example of a

    (A) logic error.

    (B) syntax error.

    (C) run-time error.

    (D) mathematical error.

20. For each week of the year, and for each day in the week, values have been kept of the number of cars using the Sydney Harbour Bridge (integer values) and the peak smog level (real values) in the central business district.

What is the most appropriate data structure for storing these data within a program that is written to analyse, for specific days of the week, the relationship between cars using the bridge and peak smog levels?

    (A) a file

    (B) a multidimensional array

    (C) a record of arrays

    (D) an array of records

SECTION II

Marks

(30 Marks)

Attempt BOTH questions.

QUESTION 21. Use a *separate* Writing Booklet. (15 marks)

(a) A programmer is testing a program. Although the program worked with one set of test data, it appears to do nothing when processing another set of test data.

    Describe TWO techniques that the programmer could use to debug the program by inserting additional code into the program.

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(b) The quality of user-interface screens contributes to the quality of the software.

    (i) Briefly describe the ways in which screen design can affect the quality of software.

    (ii) Major screen-design principles relate to:

- enhancing legibility and clarity;
- the structural organization of a screen;
- the delineation of areas on a screen.

    Select FOUR features of a well-designed screen, and explain how each feature contributes to implementing the relevant principles. Your answer must include features relating to AT LEAST TWO of the above principles. Illustrate each feature chosen with an example or diagram.

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(c) A well-documented system needs a number of external documents to enable it to be effectively implemented, used, and maintained.

    (i) Briefly describe TWO of these documents. In your answer, name the document and give a list of the major sections that it would include. State the type of material that each section should contain and justify its inclusion.

    (ii) In addition to the external documentation, a piece of software will often include on-line documentation to assist the user.

    Briefly describe TWO different forms of on-line documentation. In your answer describe how the mechanism works and what information should be contained.

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

(a) Read the following algorithms. **3**

```
BEGIN MAINPROGRAM

INITIALIZATION
set Capitals to 0
set Vowels to 0
END INITIALIZATION

read a character
WHILE (character is not "Z") AND (character is not "z")
     CASEWHERE character is  "A", "E", "I","O","U", "a","e","i","o","u":
          add 1 to Vowels
     OTHERWISE:
          IF (character >= "A") AND (character <= "Z") THEN
           add 1 to Capitals
          ENDIF
     ENDCASE
     read a character
ENDWHILE
write out "The number of vowels is", Vowels
write out "The number of capital letters is", Capitals

END MAINPROGRAM
```

Desk-check the algorithm, and clearly show what values will be written out if the following data are used.

<p align="center">Come_ to_ DUBBO_ ZOO ®</p>

where _ represents a SPACE and ® represents a CARRIAGE RETURN.

QUESTION 22. (Continued)   **Marks**

(b) A government grant for athletes is based on family income and the age of the   **6**
     athlete.

     If the family income is $25 000 or less, they receive a base grant plus the
     difference between $25 000 and the family income. If the athlete is 18 or
     younger, the base grant is $5000; otherwise it is $10 000.

     If the family income is larger than $25 000, they receive a total grant of $6000 if
     the athlete is 18 or younger; otherwise they receive a total grant of $12 000.

     Design a set of test data pairs that could be used to check an algorithm written to
     calculate the grant payable to each athlete. Justify the inclusion of each pair of
     values. You need only test for positive values.

(c) A company sponsors a game played by four players over a number of rounds.   **6**
     There is a prize of $150 for each round.

     The rules for allocating the prize-money are:

     • if one player wins the round, then that player collects the prize for that round;

     • if there is a draw on any round, except the last round, the prize for that round
       is added to the prize for the next round;

     • if the final round is drawn, all players continue to play further rounds until a
       round is won by only one player. That player receives the prize for the final
       round.

     Using pseudocode or a flowchart, write a clear and concise algorithm to
     calculate the winnings of each player.

     The algorithm is to accept as input:

     • the number of rounds set down to be played;

     • for each round played, an integer representing the number of the player who
       won the round (1–4), or 0 indicating a draw for that round.

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