BOARD OF STUDIES
NEW SOUTH WALES

**HIGHER SCHOOL CERTIFICATE EXAMINATION**

# 1996

# 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 .** Incremental program development, as opposed to other forms of program development, may involve the use of

(A) debugging.

(B) flags.

(C) loops.

(D) stubs.

**2 .** Examples of second, third, and fourth generation languages are respectively

(A) microcode, pseudocode, and object code.

(B) microcode, procedural code, and object code.

(C) COBOL, assembler code, and non-procedural code.

(D) assembler code, COBOL, and non-procedural code.

**3 .** Source code is a

(A) high level language program written by the computer programmer.

(B) code produced as a result of compiling a program written in a high level language.

(C) programming language that requires programmers to specify a step-by-step process.

(D) programming language in which each instruction corresponds to a single machine operation.

**4 .** Three forms of documentation likely to be found in a printed user manual are

(A) installation guide, function chart, and user instructions.

(B) installation guide, program listings, and balloon text.

(C) intrinsic documentation, IPO charts, and user instructions.

(D) links to tutorials, balloon text, and user instructions.

**5 .** A mainline is most likely to be found in a program written using

(A) a natural language.

(B) a declarative language.

(C) a procedural language.

(D) an event-driven language.

**6 .** The following are descriptions of four programming paradigms. Which row in the table below correctly matches all descriptions to their paradigms.

(i) Emphasises 'what the problem is' rather than 'what procedure is required to solve the problem'.

(ii) Describes the process that leads to the solution of the problem.

(iii) Actions are carried out in response to certain input or other stimuli, rather than exclusively to the program logic.

(iv) Views a program as a series of modules, each containing data, and capable of performing a series of operations on its data.

| | *Event-driven paradigm* | *Declarative paradigm* | *Object-oriented paradigm* | *Procedural paradigm* |
|---|---|---|---|---|
| (A) | (i) | (iii) | (iv) | (ii) |
| (B) | (ii) | (i) | (iv) | (iii) |
| (C) | (iii) | (i) | (iv) | (ii) |
| (D) | (iii) | (iv) | (i) | (ii) |

**7 .** One of the most fundamental components of a programming language is an expression. An expression usually consists of a combination of

(A) separators, reserved words, and operators.

(B) logical operators, delimiters, and constants.

(C) variables, constants, and boolean functions.

(D) operators, identifiers, and operands.

**8 .** Given the following definition in some programming language:

<variable> = a|e|i|o|u
<constant> = 0|1|2
<expression> = @<variable>{[<variable>|<constant>]}
<operand> = #|?|/
<statement> = <expression><operand><expression>

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

(A) @u2?e2
(B) @1#Aa1
(C) @eio/@a1
(D) @aa?@1a

USE THE FOLLOWING INFORMATION TO ANSWER QUESTIONS 9 AND 10.

A two-dimensional array 'A' contains the following values:

| | | |
|---|---|---|
| A[1, 1] = 1 | A[2, 1] = 2 | A[3, 1] = 3 |
| A[1, 2] = 2 | A[2, 2] = 3 | A[3, 2] = x |
| A[1, 3] = 3 | A[2, 3] = 4 | A[3, 3] = y |
| A[1, 4] = 2 | A[2, 4] = 3 | A[3, 4] = 2 |

**9 .** What values for x in A[3, 2] and y in A[3, 3] would result in the following expression being true?

A[ A[1, 1] + A[3, 2] , A[3, 3] – A[1, 3] ] = 2

(A) x = 1 y = 1
(B) x = 1 y = 4
(C) x = 2 y = 4
(D) x = 4 y = 1

**10 .** Which of the following is a correct representation of the array?

(A)
1 2 3
2 3 y
3 4 x
2 3 2

(B)
1 2 2
2 3 y
3 4 x
2 3 3

(C)
1 2 3 2
2 3 4 3
3 x y 2

(D)
1 2 3 2
2 3 4 3
2 x y 3

**11.** A fixed-length file may be accessed by

(A) direct methods only.

(B) sequential methods only.

(C) sequential and direct methods.

(D) conversion to a varying-length file.

**12.** Data verification

(A) is the same process as data validation.

(B) is a check carried out by the user to ensure that entered data matches the source data.

(C) is a check carried out by the computer to verify that the input data meets certain conditions.

(D) involves calculating a check-sum of the data each time it is read from disk to ensure that it has not been altered by, for example, a virus.

**13.** A driving school wants a programmer to write a program to analyse the performance of its students. The information to be stored for each student is name, age, sex, multiple-choice score, and driving test results.

Which of the following would be the most suitable data structure?

(A) data list

(B) file of records

(C) array of characters

(D) two separate arrays

**14.**
```
BEGIN
    set Count = 1
    WHILE Count < 6
        read A[Count]
        IF A[Count] ≥ 6 and ≤ 8 THEN
            print 'peak'
        ELSE
            print 'off peak'
        ENDIF
        increment Count
    ENDWHILE
END
```

Which is the most suitable set of test data for the above algorithm?

(A) 4, 5, 6, 8, 8, 9

(B) 5, 6, 7, 8, 8, 9

(C) 5, 6, 7, 8, 9

(D) 5, 6, 8, 9

**15.** Program documentation

(A) should always be present, even for short programs.

(B) is not required if the programming language is easy to understand.

(C) is produced during the *implementation and testing* stage of the system development cycle.

(D) should contain balloon text and an explanation of those variable names that are not meaningful.

**16.** Which of the following forms of documentation would a programmer find most useful when modifying a program?

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

(B) specifications, installation guide, and operation of subprograms

(C) functions of the program, extrinsic documentation, and user guide

(D) coding features, functions of the program, and operations of subprograms

**17.** Desk checking is likely to find all errors EXCEPT

(A) logic errors.

(B) syntax errors.

(C) run-time errors.

(D) program specification errors.

**18.** An example of a program with a syntactic error would be a

(A) program that has an infinite loop.

(B) program that does not compile correctly.

(C) program that stops after reporting an attempt to read past the end of a file.

(D) program that does not produce output in accordance with the specification.

USE THE FOLLOWING ALGORITHM SEGMENTS TO ANSWER QUESTIONS 19 AND 20.

(1)
```
set Count to 0
WHILE Count < 1000
    set array [Count + 1] to 0
    increment Count
ENDWHILE
```

(2)
```
set Count to 1
WHILE Count ≤ 1000
    set array [Count] to 0
    increment Count
ENDWHILE
```

(3)
```
set Count to 0
WHILE Count < 1000
    increment Count
    set array [Count] to 0
ENDWHILE
```

**19.** Which of the algorithm segments perform(s) identical tasks?

(A) 1 and 2

(B) 2 and 3

(C) 3 and 1

(D) All of them

**20.** Which of the algorithms perform(s) unnecessary calculations?

(A) 1

(B) 2

(C) 3

(D) Both 2 and 3

## SECTION II

Marks

(30 Marks)

Attempt BOTH questions.

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

Erewhon High School is developing a centralised mark-recording system that will allow the following to be entered:

- details of all students enrolled at the school;
- details of teachers employed at the school;
- details of the subjects to be taught, including the teacher assigned to each subject;
- for each assessable item in a subject, the maximum mark and item type (assignment, test, report, essay, etc.);
- a record of subjects in which each student has enrolled;
- the mark gained by each student for each assessable item.

So far, only the two following reports have been identified as being needed:

- a mark-book for students in the subject;
- a student summary for a specified student, showing all the marks in each of the subjects in which the student is enrolled.

There are also a number of administrative tasks, such as backing up files, clearing out details from previous years, etc.

(a) Representation of parts of the system can be done using a story board, IPO chart, structure diagram, or function chart. **4**

(i) Represent the centralised mark-recording system using one of these methods.

(ii) Name and describe the characteristics of ONE other method.

QUESTION 21. (Continued) **Marks**

(b) (i) 1. State FOUR different principles of screen design: TWO that contribute to the clarity and legibility of the screen, and TWO that contribute to the structural organisation of the screen. **7**

2. Sketch an appropriate main-menu screen for the Erewhon High School mark-recording system, ensuring that the FOUR principles given in your answer to part 1 are met.

3. Describe how the main-menu screen you designed satisfies the FOUR principles given in your answer to part 1.

(ii) *Radio buttons* are a screen design element that allows the user to make a choice from a number of alternatives. They are rarely used for selecting items from a main menu. Describe a situation where it is appropriate to use them.

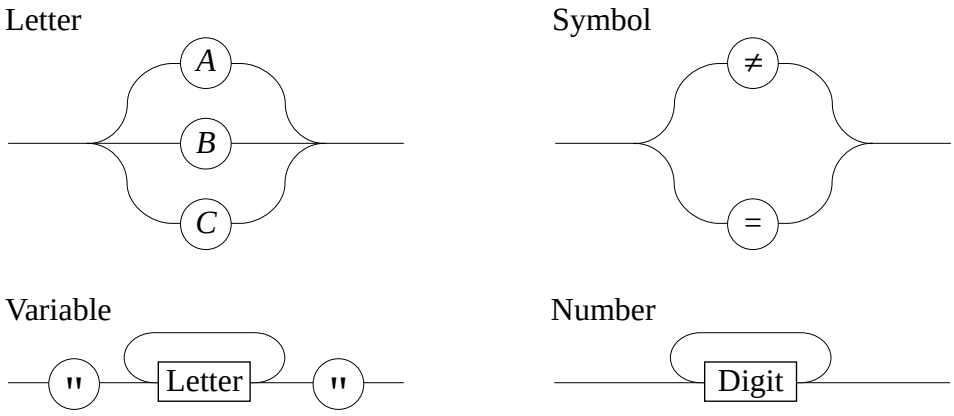
(c) The Principal of Erewhon High School has decided that a prototype of the system should be produced. **4**

(i) Describe TWO characteristics of a prototype.

(ii) Give TWO reasons why the principal may have decided that a prototype should be produced for the school's mark-recording system.

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

(a) Part of the syntax of a language is given below. **3**




The following assignment statements are syntactically correct in that language.

Assign A = "AB" END

Assign B ≠ 5 END

Assign C = "BB", Assign B = 4, Assign C = "B" END

Draw a ‘railroad’ diagram for the assignment statement in this language.

QUESTION 22. (Continued) **Marks**

(b) Consider the following pseudocode. The numbers in circles on the left of each line are present to allow lines to be easily identified, and are NOT part of the pseudocode. **6**

```
(1)  BEGIN MAINPROGRAM
(2)  INITIALISATION
(3)  get values for two integers, A and B, from the user
(4)  IF A > B THEN
(5)      set X to A
(6)      set Y to B
(7)  ELSE
(8)      set X to B
(9)      set Y to A
(10) ENDIF
(11) END INITIALISATION
(12) WHILE Y is not equal to zero
(13)     set A to the remainder when X is divided by Y
(14)     set B to Y
(15)     IF A > B THEN
(16)         set X to A
(17)         set Y to B
(18)     ELSE
(19)         set X to B
(20)         set Y to A
(21)     ENDIF
(22) ENDWHILE
(23) display X
(24) END MAINPROGRAM
```

(i) Write the results that will be produced with the following two sets of test data.

1. 6 and 12.

2. 25 and 10.

(ii) Describe TWO separate ways in which the original pseudocode could be made shorter (and still produce the *same* results). You may need to refer to parts of the existing pseudocode by line number, or to write fragments of pseudocode to answer this question.

(iii) Using an appropriate set of test data, explain the result of changing lines 12 and 22 to the following:

```
(12) REPEAT
(22) UNTIL Y is equal to zero.
```

**Question 22 continues on page 12**

QUESTION 22. (Continued) **Marks**

(c) A sprint race for athletes is to be organised. Applications are to be received with each athlete's name, club, and best time over 200 m. The fastest twenty-four applicants are to be selected to participate in three heats, and placed in eight lanes, as shown below. **6**

| | *Lane* | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Heat 1 | Fastest | 4th fastest | 7th | | | | | 22nd |
| Heat 2 | 2nd fastest | 5th fastest | etc. | | | | | 23rd |
| Heat 3 | 3rd fastest | 6th fastest | | | | | | 24th |

The mainline for the program is as follows:

```
BEGIN MAINPROGRAM
    initialisation
    read-all-data
    sort
    print-top-24-runners
END MAINPROGRAM
```

Procedure read-all-data reads the athlete's name, club, and best time into three arrays called Name, Club, and Time. The procedure ends when the athlete's name field contains 'ZZZ'.

Procedure sort sorts the three arrays in ascending order of best time, so that Name [1], Club [1], and Time [1] contain the details of the fastest athlete.

Procedure print-top-24-runners prints the athlete's name, club, best time, heat, and lane for the fastest 24 athletes. The details are printed in ascending best time sequence.

Using pseudocode or flowcharts, write clear and concise algorithms for:

(i) the procedure read-all-data;

(ii) the procedure print-top-24-runners.