BOARD OF STUDIES
NEW SOUTH WALES

HIGHER SCHOOL CERTIFICATE EXAMINATION

2000

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.

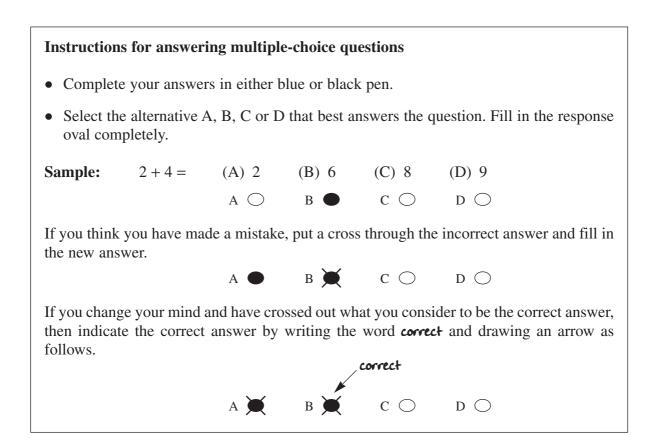- Complete your answers in either blue or black pen on the Answer Sheet provided.

Section II (30 marks)

- Attempt BOTH questions.

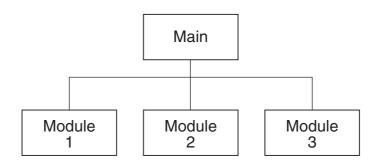- Answer each question in a SEPARATE Writing Booklet.

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

A ◯   B ●   C ◯   D ◯

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

A ●   B ✖   C ◯   D ◯

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.

correct

A ✖   B ✖   C ◯   D ◯

1 A machine language instruction consists of two basic parts. The first is the numerical operation code. What is the other part?

(A) Addresses

(B) Branch codes

(C) Op codes

(D) Operands

2

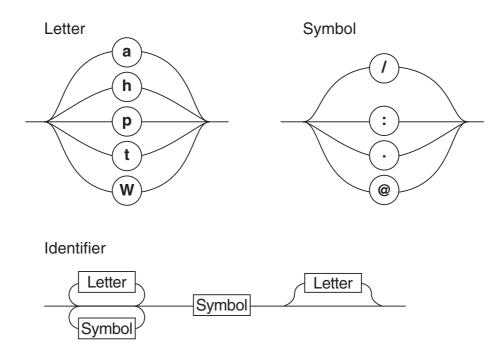Which system representation method has been employed to construct the diagram?

(A) IPO chart

(B) Linear storyboard

(C) Function chart

(D) Case diagram

3 An interactive computer-based system is to be developed for a dinosaur park, to display the site map and to give directions. Which is the most appropriate method for representing this system?

(A) Storyboard

(B) Function chart

(C) Hierarchy chart

(D) Structure diagram

4 Which generation of computing languages marked the transition from the traditional programmer-dependent approach to end-user programming?

(A) First generation

(B) Second generation

(C) Third generation

(D) Fourth generation

5 A large complex program is to be developed in a modular approach. Some of the modules are already completed and tested, while others are still being developed. Which is the most efficient translation process for developing this program so that only the changed modules need to be re-translated?

(A) Interpretative compilation

(B) Independent compilation

(C) Incremental compilation

(D) Modular compilation

6 The following EBNF rules completely describe the syntax of a computer language.

$$<\text{digit}> \quad = \quad 0\,|\,1\,|\,2\,|\,3\,|\,4\,|\,5\,|\,6\,|\,7\,|\,8\,|\,9$$

$$<\text{expression}> \quad = \quad [+\,|\,-]\,<\text{digit}>\,\{<\text{digit}>\}\,+\,B[+\,|\,-]<\text{digit}>$$

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

(A) $-3 + B - 3$

(B) $+3 - B - 3$

(C) -0.33

(D) $+33 + B + B$

7 The following railroad diagrams define an identifier.

Letter

Symbol

Identifier

Which identifier is valid according to the diagrams?

(A) http://www

(B) pat@hat/

(C) :www.apt.com

(D) t_hat@p

8 In constructing a structure diagram, what is the conventional symbol used to show a control parameter?

(A) ▭

(B) ◇

(C) ○⟶

(D) ●⟶

9 A program includes a calculation routine that is called from many points in the main program. The calculation result is not always correct. What would be the best technique for the programmer to use to trace the source of the errors?

(A) Using stubs

(B) Using flags

(C) Run-time checking

(D) Debugging output statements

10 A window that appears on a computer screen displaying information and allowing the user to make a selection is known as

(A) a check box.

(B) an option box.

(C) a dialogue box.

(D) an information box.

11 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

12 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) 555555557

(D) 555555557222

13 Errors that cause a program to repeat commands indefinitely are called

(A) logical errors.

(B) syntax errors.

(C) run-time errors.

(D) structural errors.

14 What kind of error is most likely to be found during a desk check?

(A) Syntax

(B) Logic

(C) Design

(D) Mathematical

15 Which software development process has requirements, design and construction occurring almost simultaneously?

(A) Top down

(B) Bottom up

(C) Logical

(D) Prototyping

16
```
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

17 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

18   The following diagram describes the seating layout of a small theatre.

	A	B	C	D	E	F	G
1							
2							
3							
4							
5							
6							

The most appropriate data structure for representing this seating layout in a program is

(A)   a record.

(B)   a one-dimensional array.

(C)   a two-dimensional array.

(D)   a string.

19   The type of validation used to check that the total weekly pay for an employee does not exceed $3000 is a

(A)   completeness check.

(B)   reasonableness check.

(C)   boundary check.

(D)   type check.

20   Which of the following may be included in intrinsic documentation?

(A)   A tutorial

(B)   Details of the operation of subprograms

(C)   Appropriate names for modules and variables

(D)   Comments appearing at appropriate places in the source code

SECTION II

Marks

(30 Marks)

Attempt BOTH questions.

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

(a)   (i)   You have been given the user manual for three software packages.   **5**
What criteria would you use to evaluate these manuals?
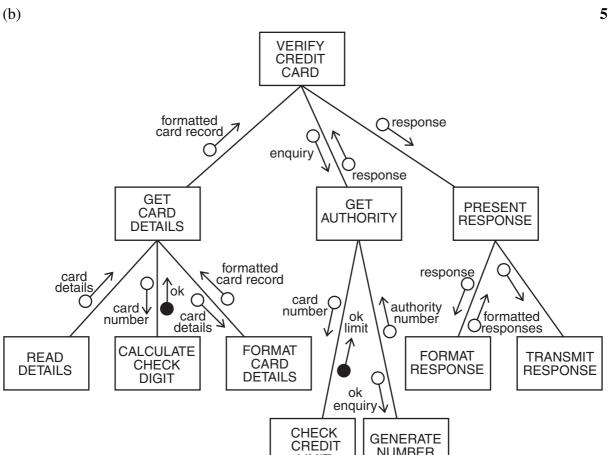
Justify your choice of criteria.

      (ii)   It has been suggested that the algorithm for the program be included in
the user manual. Would you agree or disagree with this suggestion?

Give reasons for your answer.

     (iii)   High-level languages are said to be machine-independent.

Explain what is meant by the term *machine-independent*, and describe
how machine independence is achieved.

Question 21 continues on page 12

QUESTION 21 (Continued)   **Marks**

(b)   **5**

(i)   Describe, in words, the sequence of system processes shown in the chart above.
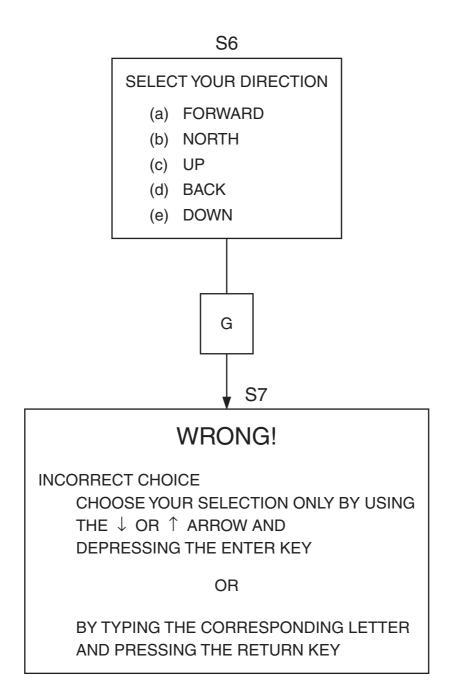
(ii) Use another method of system representation to describe the system processes shown above.

QUESTION 21 (Continued)   **Marks**

(c)   S6 is a screen from an adventure game.   **5**

      The player enters selection G and screen S7 is then displayed.

S6

```
┌─────────────────────────────┐
│ SELECT YOUR DIRECTION        │
│                              │
│      (a)  FORWARD            │
│      (b)  NORTH              │
│      (c)  UP                 │
│      (d)  BACK               │
│      (e)  DOWN               │
│                              │
└─────────────────────────────┘
              │
         ┌────────┐
         │   G    │
         └────────┘
              │
              ▼
```

S7

```
┌──────────────────────────────────────────┐
│              WRONG!                        │
│                                            │
│  INCORRECT CHOICE                          │
│       CHOOSE YOUR SELECTION ONLY BY USING  │
│       THE ↓ OR ↑ ARROW AND                 │
│       DEPRESSING THE ENTER KEY             │
│                                            │
│              OR                            │
│                                            │
│       BY TYPING THE CORRESPONDING LETTER   │
│       AND PRESSING THE RETURN KEY          │
│                                            │
└──────────────────────────────────────────┘
```

   (i)   Evaluate the effectiveness of these screens with reference to the major
         screen design principles.

   (ii) Redesign both screens so that they adhere to acceptable design
         principles. Annotate and justify your changes.

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

(a)　A tollgate at a bridge is controlled by a set of red and green lights.　　**7**

Conditions

- Red light　　— 　no passage.
- Green light　— 　passage for one vehicle.

Operations

- A sensor in the road detects:
  - the presence of a vehicle
  - the presence of a pre-paid pass on a vehicle.
- A pre-paid pass automatically switches the light from red to green.
- There is a toll of $2·50 for each vehicle without a pre-paid pass.
- Only $2, $1 and 50c coins are accepted.
- Once the $2·50 is paid, the light switches from red to green.
- After each vehicle passes through the tollgate on a green light, the light is reset to red.
- An alarm is sounded and a photograph is taken if a vehicle passes through the tollgate while the light is red.

Using EITHER pseudocode OR a flowchart, write a simple and elegant algorithm, including at least ONE sub-program, to describe the control of the tollgate.

QUESTION 22 (Continued)   **Marks**

(b)   A programming language has the following syntax, structure and rules.   **8**

Syntax

Letter = (A…Z, a...z)
Digit = (0…9)
Operand = (+ | − | * | /)
Condition = (< | < = | = | > | > = | < >)
Variable = < Letter > {< Letter > | < Digit >}
Constant = (“{ < Letter > | < Digit >}” | { < Digit >})
File Name = < Constant >
Condition Exp = < Variable > < Condition > (< Variable > | < Constant >)
Variable List = (< Variable > | < Constant >) {, < Variable > | , < Constant}

Structure

Assignment Statement
< Variable > : = < Variable > {< Operand > (< Variable > | < Constant >)}

Conditional
IF < Condition Exp > THEN … [ELSE] … ENDIF

Repetition
DOWHILE < Condition Exp > … ENDDO

File Operations
FILEOPEN < File Name >
FILECLOSE < File Name >
RECORDFIND < File Name > KEY < Variable >
RECORDUPDATE < File Name >

Screen Operations
SCREENREAD < Variable >
PRINTSCREEN < Variable List >

Print Operations
LINEPRINT < Variable List >

Program Structure
PROGRAM < Variable >
DECLARE VARIABLES {< Variable > (NUMERIC | CHARACTER)}
DECLARE FILES {< File Name > RECORD < Variable List > KEY < Variable >}
BEGIN MAIN
        Main program logic goes here
END MAIN
END PROGRAM

QUESTION 22 (Continued)   **Marks**

Rules

1   ALL program variables must be declared in the DECLARE VARIABLES statement.

2   ALL files must be declared in the DECLARE FILES statement.

3   ALL files must be opened before any operation can be performed on them.

4   ALL files must be closed before a program finishes.

5   An EXIT statement in the MAIN Section ends the program.

6   When a RECORDFIND statement is obeyed, the Boolean system Variable &FOUND (which does not have to be declared) is set to True if the matching record is found, otherwise it is set to False.

7   A record must be found before it can be updated.

8   Program comments begin with a single apostrophe.

The following is an algorithm which describes the process of adjusting the quantity of parts held in a database file.

```
BEGIN Inventory Program
    OPEN Parts File
    READ Part Number from screen input
    WHILE Part Number < > 9999
        READ Parts File using Part Number
        IF record found THEN
            READ Quantity from screen
            PARTQTY = PARTQTY + Quantity
            UPDATE record
            PRINT PARTNO, PARTDESC, PARTQTY to report
        ELSE
            Display Error Message on screen
        ENDIF
        READ Part Number from screen input
    ENDWHILE
    CLOSE Parts File
END Inventory Program
```

Convert the algorithm into a program using the programming language described above. The name of the file holding the parts data is "PARTS". The structure is as follows:

PARTNO	NUMERIC	—	Part number
PARTDESC	CHARACTER	—	Part description
PARTQTY	NUMERIC	—	Quantity of the part in warehouse

The KEY of the file is PARTNO.

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