

BOARD OF STUDIES
NEW SOUTH WALES

HIGHER SCHOOL CERTIFICATE EXAMINATION

1998
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.
- Write your Student Number and Centre Number on the Answer Sheet provided.
- Complete your answers in blue or black pen, or 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.

Complete your answers in blue or black pen, or in pencil on the Answer Sheet provided.

1. The translation, one line at a time, of source code to object code is done using
 - (A) an editor.
 - (B) an iterator.
 - (C) a compiler.
 - (D) an interpreter.

2. The use of the variable name HOURLY_RATE is an example of documentation that is
 - (A) online.
 - (B) internal.
 - (C) intrinsic.
 - (D) external.

3. The program segment

```
on   MouseButton  
    sound BEEP  
end  MouseButton
```

most closely resembles a program written using a

- (A) natural language.
- (B) procedural language.
- (C) declarative language.
- (D) event-driven language.

4. The elements of the integer ARRAY A are shown below.

	1	2	3	4
1	1	2	2	Y
2	6	7	1	3
3	5	1	X	2
4	Y	3	2	8

If $A[3,1] = 5$

and

$$A[1,1] + A[1,2] + A[1,3] + A[1,4] = X$$

and

$$A[1,1] + A[2,1] + A[3,1] + A[4,1] = 2 * X$$

then the value of

$$A[3,1] + A[3,2] + A[3,3] + A[3,4] \text{ is}$$

- (A) 2
 - (B) 5
 - (C) 15
 - (D) 20
5. 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
```

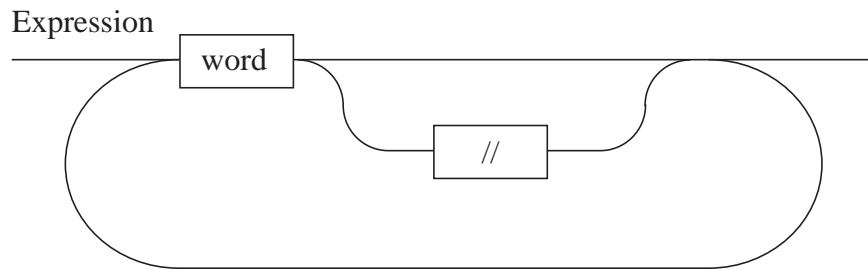
will result in

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

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

$$\text{vowel} = a \mid e \mid i \mid o \mid u$$

$$\text{digit} = 0 \mid 1 \mid 2 \mid 3 \mid 4$$

$$\text{word} = \langle \text{vowel} \rangle \{ \langle \text{digit} \rangle \}^*$$


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

- (A) a2b* // e3*
- (B) a23* // e314*
- (C) u3a4* // a* //
- (D) e23*4b // e3* //
7. In a computer language, the statement 'Count + + ;' is taken to mean 'Set Count to Count + 1;'
- In the statement above, Count is an
- (A) op code.
- (B) operand.
- (C) operator.
- (D) object code.
8. A main program calls Procedures A, B and C. Procedure B is not fully written, but just returns a value so that the main program can be tested. This is an example of the use of
- (A) stubs.
- (B) drivers.
- (C) desk-checking modules.
- (D) documentation modules.

9. 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 | (B) | 2 | 2 | 2 | 2 |
| | 3 | 4 | 5 | 6 | | 3 | 3 | 3 | 3 |
| | 4 | 5 | 6 | 7 | | 4 | 4 | 4 | 4 |
| | 5 | 6 | 7 | 8 | | 5 | 5 | 5 | 5 |
| (C) | 5 | 6 | 7 | 8 | (D) | 2 | 3 | 4 | 5 |
| | 4 | 5 | 6 | 7 | | 2 | 3 | 4 | 5 |
| | 3 | 4 | 5 | 6 | | 2 | 3 | 4 | 5 |
| | 2 | 3 | 4 | 5 | | 2 | 3 | 4 | 5 |

10. LD A, 16
LD B, 3
ADD A, B

Which type of language is represented by the code above?

- (A) Assembler
- (B) Declarative
- (C) Higher-level
- (D) Object-oriented

11. 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?

- | | |
|--|--|
| <p>(A) BEGIN
 Set Count to 1
 WHILE Count < 500
 FIDO [Count] = 9
 Count = Count + 1
 ENDWHILE
 END</p> | <p>(B) BEGIN
 Set Count to 0
 WHILE Count < 500
 FIDO [Count + 1] = 9
 Count = Count + 1
 ENDWHILE
 END</p> |
| <p>(C) BEGIN
 Set Count to 1
 REPEAT
 FIDO [Count + 1] = 9
 Count = Count + 1
 UNTIL Count < 500
 END</p> | <p>(D) BEGIN
 Set Count to 0
 REPEAT
 FIDO [Count] = 9
 Count = Count + 1
 UNTIL Count < 500
 END</p> |

12. The results of the high-jump event at an athletics carnival were entered into a spreadsheet program. You were asked to compare a printout of the entered values against the original paper copies of the results. Which of the following processes would you have undertaken?

- (A) Debugging
- (B) Desk checking
- (C) Data validation
- (D) Data verification

13. Most program compilers have a number of options to determine the way compilation is performed and the types of listing output. The best way to allow multiple options to be selected would be the use of

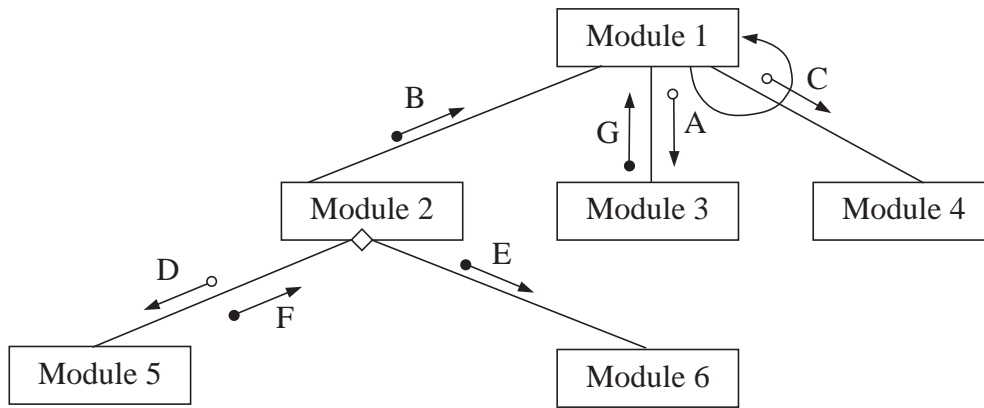
- (A) an icon.
- (B) a window.
- (C) a choice box.
- (D) a radio button.

14. Errors that cause programs to process data incorrectly are called

- (A) logical errors.
- (B) syntax errors.
- (C) run-time errors.
- (D) structural errors.

15. Computer A uses the one's complement number system, and computer B uses the two's complement number system. Both use 16 bits to represent integers. What is the allowable range of values that each can represent?
- (A) A: -32768 to $+32768$, B: -32768 to $+32768$.
 - (B) A: -32768 to $+32767$, B: -32767 to $+32767$
 - (C) A: -32767 to $+32767$, B: -32768 to $+32768$
 - (D) A: -32768 to $+32768$, B: -32768 to $+32767$
16. A programming language states what should happen rather than how the processing should take place. The language is
- (A) structured.
 - (B) procedural.
 - (C) declarative.
 - (D) object-oriented.
17. The machine language program equivalent to the original language version of a program is called
- (A) object code.
 - (B) source code.
 - (C) compiled code.
 - (D) emulator code.
18. Prototyping is a procedure that
- (A) requires end-user participation.
 - (B) enables all system design factors to be solved.
 - (C) eliminates the need for system documentation.
 - (D) requires each of the system development phases to be carried out in sequence.
19. User help and balloon text are both examples of
- (A) on-line documentation.
 - (B) internal documentation.
 - (C) intrinsic documentation.
 - (D) algorithm documentation.

20.



The illustration above is an example of

- (A) a storyboard.
- (B) an IPO chart.
- (C) a procedure chart.
- (D) a structure diagram.

SECTION II**Marks**

(30 Marks)

Attempt BOTH questions.

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

- (a) A computer programmer has been presented with the following four software development projects. **4**
- (i) A touch-screen information directory to be placed at the entrance to a store
 - (ii) An expert system, using artificial intelligence techniques, to assist a doctor in diagnosing illness from a range of symptoms
 - (iii) A system to process the monthly payroll for a small company
 - (iv) A program which simulates a pin-ball game that has targets on specified areas of the screen and uses the keyboard to control flippers

If you had to choose between an event-driven, procedural, declarative or object-oriented implementation for EACH of the above projects, which would you choose? Justify your choice for each project.

Question 21 continues on page 10

QUESTION 21. (Continued)

Marks

Use this material for Question 21 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 are summarised below.

<i>Camper</i>	<i>Activities</i>	<i>Camper activity</i>
camper_id	activity_code	camper_id
family_name	activity_name	activity_code
first_name		
home_address		
phone_number		
date_of_birth		
gender		

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.

QUESTION 21. (Continued)

Marks

- (b) (i) Design and draw the entry screen for the camper registration program. **5**
- (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: **6**
- 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 22. Use a SEPARATE Writing Booklet. (15 marks)

Marks

- (a) HOLD is a ten-element array that is used to store words. It does so with each of its elements storing either a letter of the word or the blank character ∇ . **7**

EXAMPLE

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

- (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.

QUESTION 22. (Continued)

Marks

- (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. 8

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:

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

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