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COMPUTER SCIENCE

9618/22

Paper 2 Fundamental Problem-solving and Programming Skills

May/June 2022

2 hours

You must answer on the question paper.

You will need: Insert (enclosed)

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use an HB pencil for any diagrams, graphs or rough working.
- Calculators must **not** be used in this paper.

INFORMATION

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [].
- No marks will be awarded for using brand names of software packages or hardware.
- The insert contains all the resources referred to in the questions.

This document has **20** pages. Any blank pages are indicated.

Refer to the **insert** for the list of pseudocode functions and operators.

- 1 (a) A programmer is testing a program using an Integrated Development Environment (IDE). The programmer wants the program to stop when it reaches a specific instruction or program statement in order to check the value assigned to a variable.

Give the technical term for the position at which the program stops.

..... [1]

- (b) The following table lists some activities from the program development life cycle.

Complete the table by writing the life cycle stage for each activity.

Activity	Life cycle stage
An identifier table is produced.	
Syntax errors can occur.	
The developer discusses the program requirements with the customer.	
A trace table is produced.	

[4]

- (c) An identifier table includes the names of identifiers used.

State **two other** pieces of information that the identifier table should contain.

1

2

[2]

- (d) The pseudocode statements in the following table may contain errors.

State the error in each case or write 'NO ERROR' if the statement contains no error.

You can assume that none of the variables referenced are of an incorrect type.

Statement	Error
Status ← TRUE AND FALSE	
IF LENGTH("Password") < "10" THEN	
Code ← LCASE("Electrical")	
Result ← IS_NUM(-27.3)	

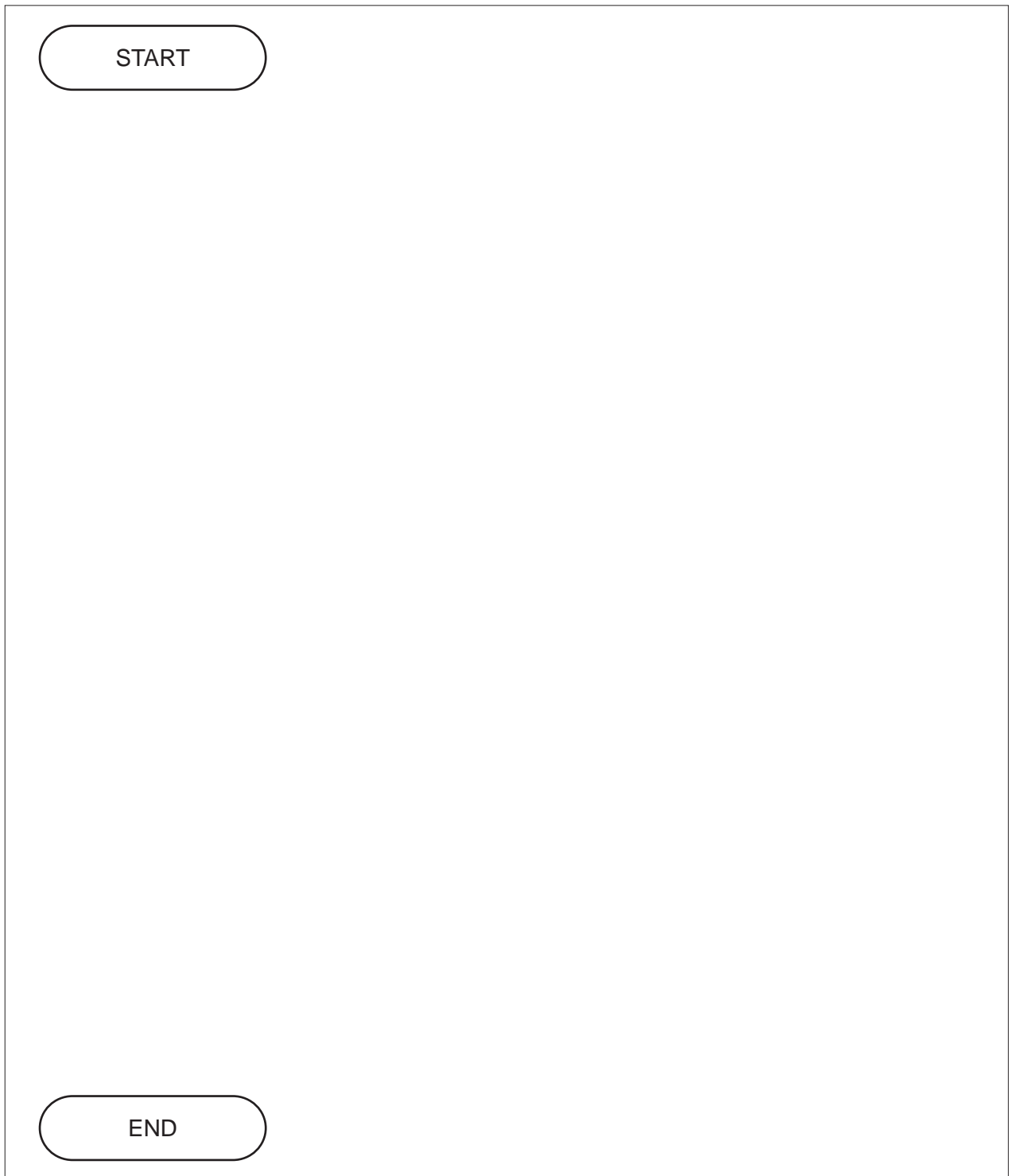
[4]

3

2 An algorithm is described as follows:

1. Input an integer value.
2. Jump to step 6 if the value is less than zero.
3. Call the function `IsPrime()` using the integer value as a parameter.
4. Keep a count of the number of times function `IsPrime()` returns `TRUE`.
5. Repeat from step 1.
6. Output the value of the count with a suitable message.

Draw a program flowchart to represent the algorithm.



[4]

3 (a) The module headers for five modules in a program are defined in pseudocode as follows:

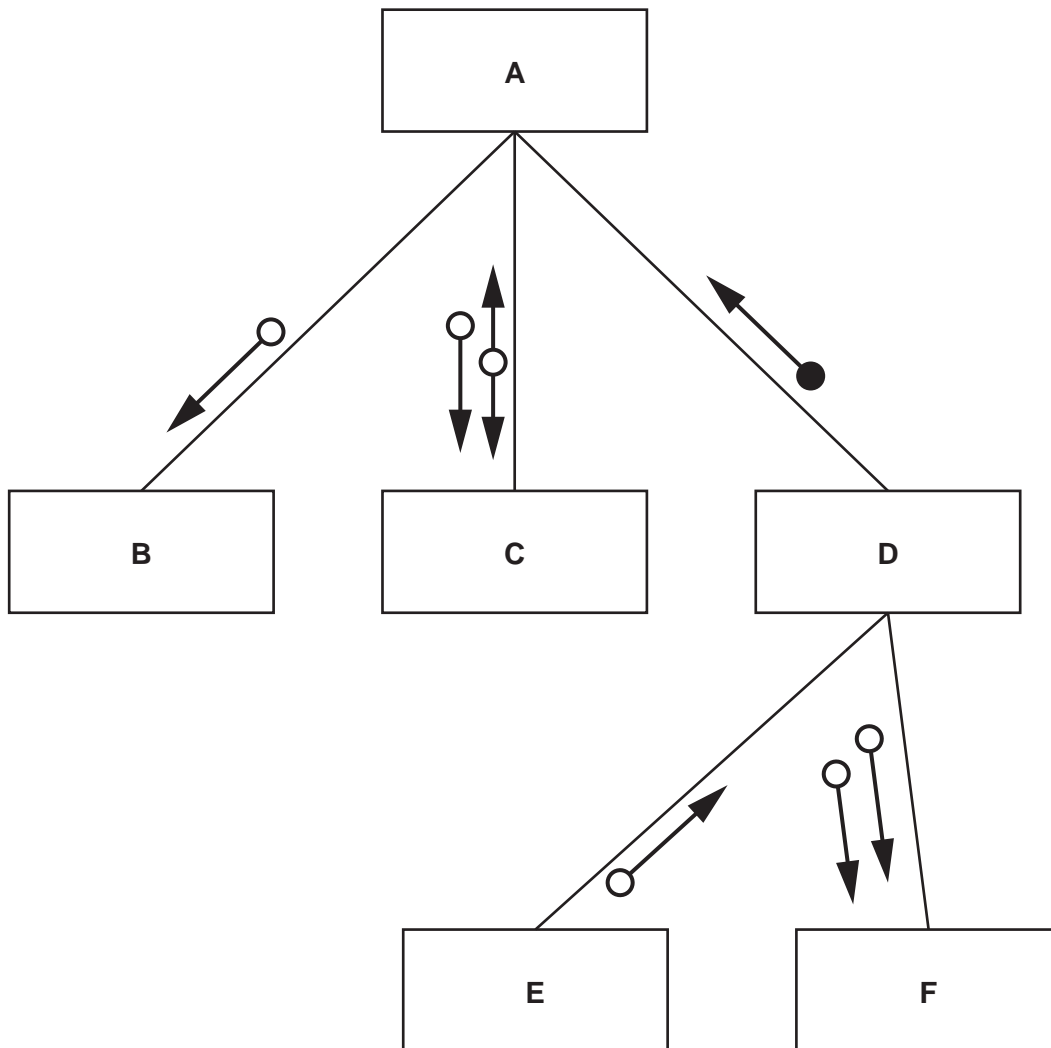
Pseudocode module header
FUNCTION Mod_V(S2 : INTEGER) RETURNS BOOLEAN
PROCEDURE Mod_W(P4 : INTEGER)
PROCEDURE Mod_X(T4 : INTEGER, BYREF P3 : REAL)
PROCEDURE Mod_Y(W3 : REAL, Z8 : INTEGER)
FUNCTION Mod_Z(F3 : REAL) RETURNS INTEGER

An additional module Head() repeatedly calls three of the modules in sequence.

A structure chart has been partially completed.

(i) Complete the structure chart to include the information given about the six modules.

Do **not** label the parameters and do **not** write the module names.



[3]

- (ii) Complete the table using the information in **part 3(a)** by writing each module name to replace the labels **A** to **F**.

Label	Module name
A	
B	
C	
D	
E	
F	

[3]

- (b) The structure chart represents part of a complex problem. The process of decomposition is used to break down the complex problem into sub-problems.

Describe **three** benefits of this approach.

1

.....

2

.....

3

.....

[3]

(b) The algorithm in **part (a)** is to be amended. The calling program will pass the number of lines to be output as well as the name of the text file.

The number of lines could be any value from 1 to 30.

It can be assumed that the file contains **at least** the number of lines passed.

Outline **three** changes that would be needed.

1

.....

.....

2

.....

.....

3

.....

.....

[3]

5 Study the following pseudocode. Line numbers are for reference only.

```

10 PROCEDURE Encode()
11   DECLARE CountA, CountB, ThisNum : INTEGER
12   DECLARE ThisChar : CHAR
13   DECLARE Flag : BOOLEAN
14   CountA ← 0
15   CountB ← 10
16   Flag ← TRUE
17   INPUT ThisNum
18   WHILE ThisNum <> 0
19     ThisChar ← LEFT(NUM_TO_STR(ThisNum), 1)
20     IF Flag = TRUE THEN
21       CASE OF ThisChar
22         '1' : CountA ← CountA + 1
23         '2' : IF CountB < 10 THEN
24             CountA ← CountA + 1
25             ENDIF
26         '3' : CountB ← CountB - 1
27         '4' : CountB ← CountB - 1
28             Flag ← FALSE
29         OTHERWISE : OUTPUT "Ignored"
30       ENDCASE
31     ELSE
32       IF CountA > 2 THEN
33         Flag ← NOT Flag
34         OUTPUT "Flip"
35       ELSE
36         CountA ← 4
37       ENDIF
38     ENDIF
39     INPUT ThisNum
40   ENDWHILE
41   OUTPUT CountA
42 ENDPROCEDURE

```

(a) Procedure `Encode()` contains a loop structure.

Identify the type of loop **and** state the condition that ends the loop.

Do **not** include pseudocode statements in your answer.

Type

Condition

.....

[2]

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- 8 A program allows a user to save passwords used to log in to websites. A stored password is then inserted automatically when the user logs in to the corresponding website.

A global 2D array `Secret` of type `STRING` stores the passwords together with the website domain name where they are used. `Secret` contains 1000 elements organised as 500 rows by 2 columns.

Unused elements contain the empty string (`" "`). These may occur anywhere in the array.

An example of a part of the array is:

Array element	Value
<code>Secret[27, 1]</code>	<code>"thiswebsite.com"</code>
<code>Secret[27, 2]</code>	<code>"....."</code>
<code>Secret[28, 1]</code>	<code>"thatwebsite.com"</code>
<code>Secret[28, 2]</code>	<code>"....."</code>

Note:

- For security, the passwords are stored in an encrypted form, shown as `"....."` in the example.
- The passwords cannot be used without being decrypted.
- You may assume that the encrypted form of a password will **NOT** be an empty string.

The programmer has started to define program modules as follows:

Module	Description
<code>Exists()</code>	<ul style="list-style-type: none"> • Takes two parameters: <ul style="list-style-type: none"> ◦ a string ◦ a character • Performs a case-sensitive search for the character in the string • Returns <code>TRUE</code> if the character occurs in the string, otherwise returns <code>FALSE</code>
<code>Encrypt()</code>	<ul style="list-style-type: none"> • Takes a password as a parameter of type string • Returns the encrypted form of the password as a string
<code>Decrypt()</code>	<ul style="list-style-type: none"> • Takes an encrypted password as a parameter of type string • Returns the decrypted form of the password as a string

Note: in a case-sensitive comparison, `'a'` is not the same as `'A'`.

- (c) A password has a fixed format, consisting of **three groups of four** alphanumeric characters, separated by the hyphen character '-'.

An example of a password is:

"FxAf-3haV-Tq49"

Each password must:

- be 14 characters long
- be organised as three groups of four alphanumeric characters. The groups are separated by hyphen characters
- not include any duplicated characters, except for the hyphen characters.

An algorithm is needed for a new function `GeneratePassword()`, which will generate and return a password in this format.

Assume that the following modules have already been written:

Module	Description
<code>Exists()</code>	<ul style="list-style-type: none"> • Takes two parameters: <ul style="list-style-type: none"> ○ a string ○ a character • Performs a case-sensitive search for the character in the string • Returns <code>TRUE</code> if the character occurs in the string, otherwise returns <code>FALSE</code>
<code>RandomChar()</code>	<ul style="list-style-type: none"> • Generates a single random character from within one of the following ranges: <ul style="list-style-type: none"> ○ 'a' to 'z' ○ 'A' to 'Z' ○ '0' to '9' • Returns the character

Note: in a case-sensitive comparison, 'a' is not the same as 'A'.

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