w22 qp 21:

(c) 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.

Assume that any variables used are of the correct type for the given function.

Statement	Error
`IF EMPTY ← "" THEN`	
`Status ← IS_NUM(-23.4)`	
`X ← STR_TO_NUM("37") + 5`	
`Y ← STR_TO_NUM("37" + "5")`	

[4]

2 A system is being developed to help manage a car hire business. A customer may hire a car for a number of days.

An abstract model needs to be produced.

(a) Explain the process of abstraction **and** state **four** items of data that should be stored each time a car is hired.

Explanation .....

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Item 1 .....

Item 2 .....

Item 3 .....

Item 4 .....

[3]

(b) Identify **two** operations that would be required to process the car hire data.

Operation 1 .....

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Operation 2 .....

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[2]

3 A 1D array `Data` of type integer contains 200 elements. Each element has a unique value.

An algorithm is required to search for the largest value and output it.

Describe the steps that the algorithm should perform.

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

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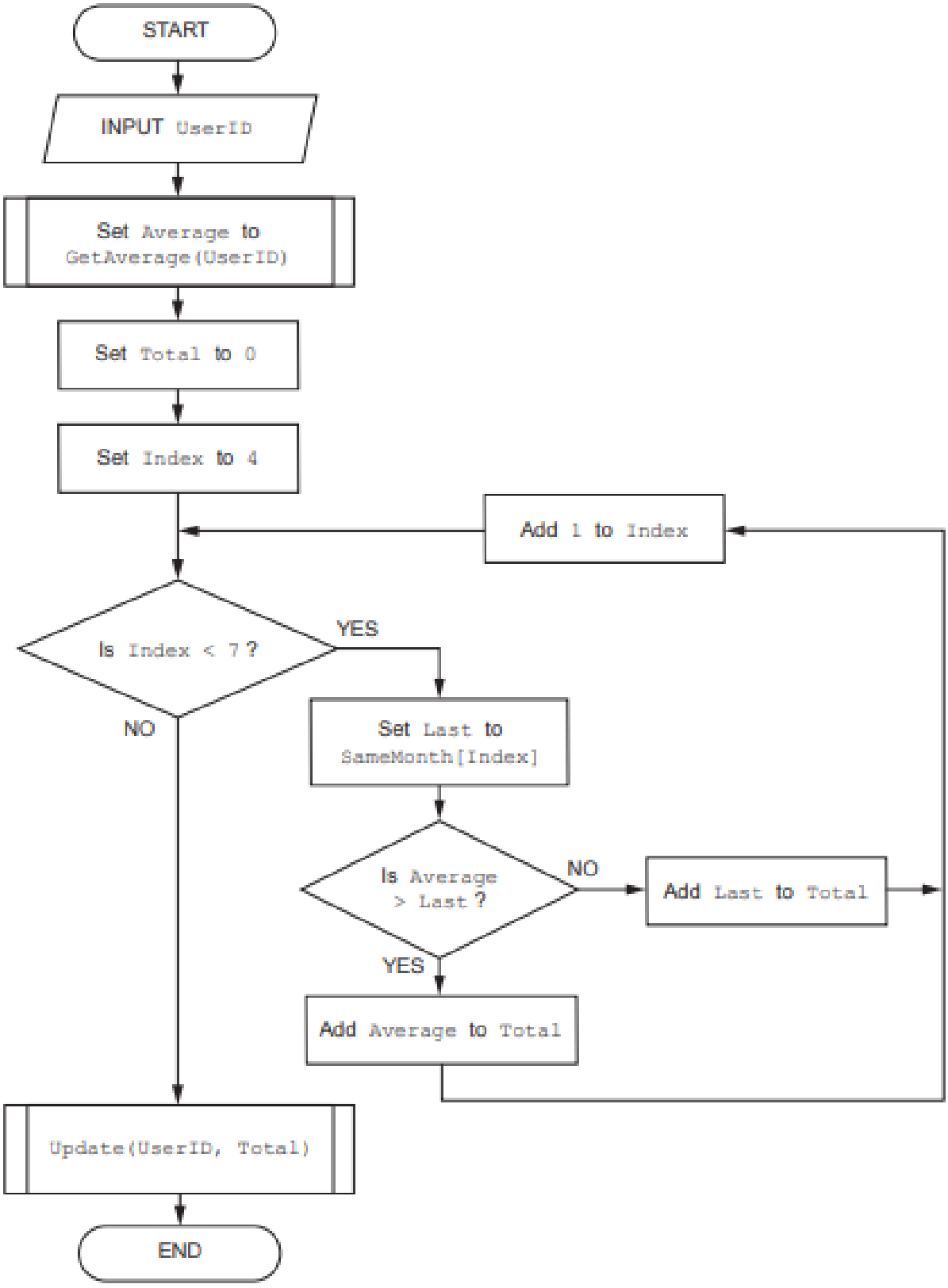
..... [5]

w22 qp 22:

4 The program flowchart represents a simple algorithm.



(a) Write the equivalent pseudocode for the algorithm represented by the flowchart.

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..... [6]

(b) Give the name of the iterative construct in the flowchart.

..... [1]

5 Examine the following pseudocode.

```
IF A = TRUE THEN
   IF B = TRUE THEN
      IF C = TRUE THEN
         CALL Sub1()
      ELSE
         CALL Sub2()
      ENDIF
   ENDIF
ELSE
   IF B = TRUE THEN
      IF C = TRUE THEN
        CALL Sub4()
      ELSE
        CALL Sub3()
      ENDIF
   ELSE
      IF C = FALSE THEN
        CALL Sub3()
      ELSE
        CALL Sub4()
      ENDIF
   ENDIF
ENDIF
```

A programmer wants to re-write the pseudocode as **four** separate `IF...THEN...ENDIF` statements, each containing a single `CALL` statement. This involves writing a single, simplified logic expression as the condition in each statement.

Write the amended pseudocode.

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[4]

w22 qp 23:

2 A program is being designed for a smartphone to allow users to send money to the charity of their choice.

Decomposition will be used to break the problem down into sub-problems.

Identify **three** program modules that could be used in the design **and** describe their use.

Module 1 .....

Use .....

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Module 2 .....

Use .....

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Module 3 .....

Use .....

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3 An algorithm is needed to process a sequence of numbers. Numbers may be positive or negative and may be integer or decimal.

The algorithm will:

- prompt and input one number at a time until the value zero is input
- sum the negative numbers
- sum the positive numbers
- when zero is input, output the two sum values and then end.

Describe the algorithm needed. Do **not** include pseudocode statements in your answer.

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..... [5]

s22 qp 21:

1 **(a)** A programmer draws a program flowchart to show the sequence of steps required to solve a problem.

Give the technical term for a sequence of steps that describe how to solve a problem.

.....

..... [1]

(c) Complete the table by evaluating each expression.

Expression	Evaluation
`INT((31 / 3) + 1)`	
`MID(TO_UPPER("Version"), 4, 2)`	
`TRUE AND (NOT FALSE)`	
`NUM_TO_STR(27 MOD 3)`	

[4]

3 The manager of a cinema wants a program to allow users to book seats. The cinema has several screens. Each screen shows a different film.

(a) Decomposition will be used to break the problem down into sub-problems.

Describe **three** program modules that could be used in the design.

Module 1 .....

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Module 2 .....

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Module 3 .....

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[3]

7 A string is a palindrome if it reads the same forwards as backwards.

The following strings are examples of palindromes:

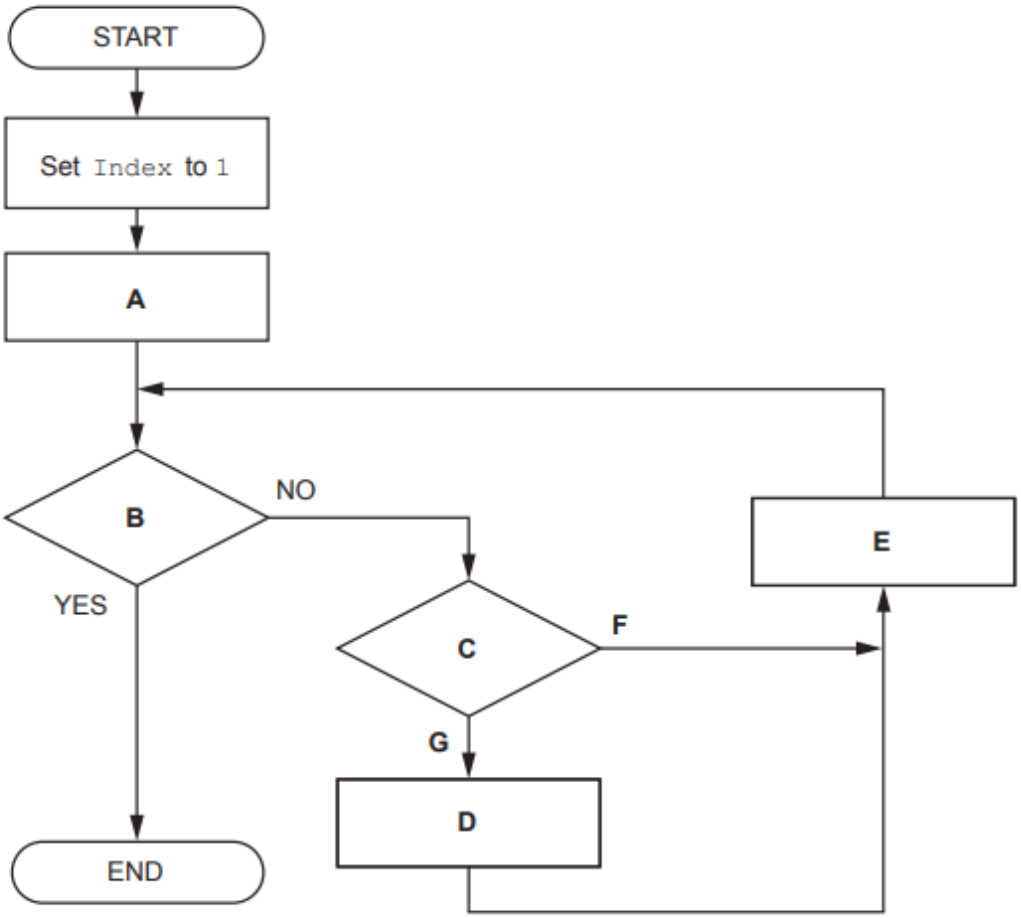
"Racecar"
"madam"
"12344321"

Upper-case and lower-case characters need to be treated the same. For example, 'A' is equivalent to 'a'.

(b) Strings may consist of several words separated by spaces.

For example, the string "never odd or even" becomes a palindrome if the spaces are removed.

The program flowchart represents an algorithm to produce a string `OutString` by removing all spaces from a string `InString`.



Complete the table by writing the text that should replace each of the labels **B**, **C**, **D**, **F** and **G**.

Note: the text may be written as a pseudocode statement.

Label	Text
A	Set `OutString` to `""`
B	
C	
D	
E	Set `Index` to `Index + 1`
F	
G	

[4]

s22 qp 22:

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.

(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.

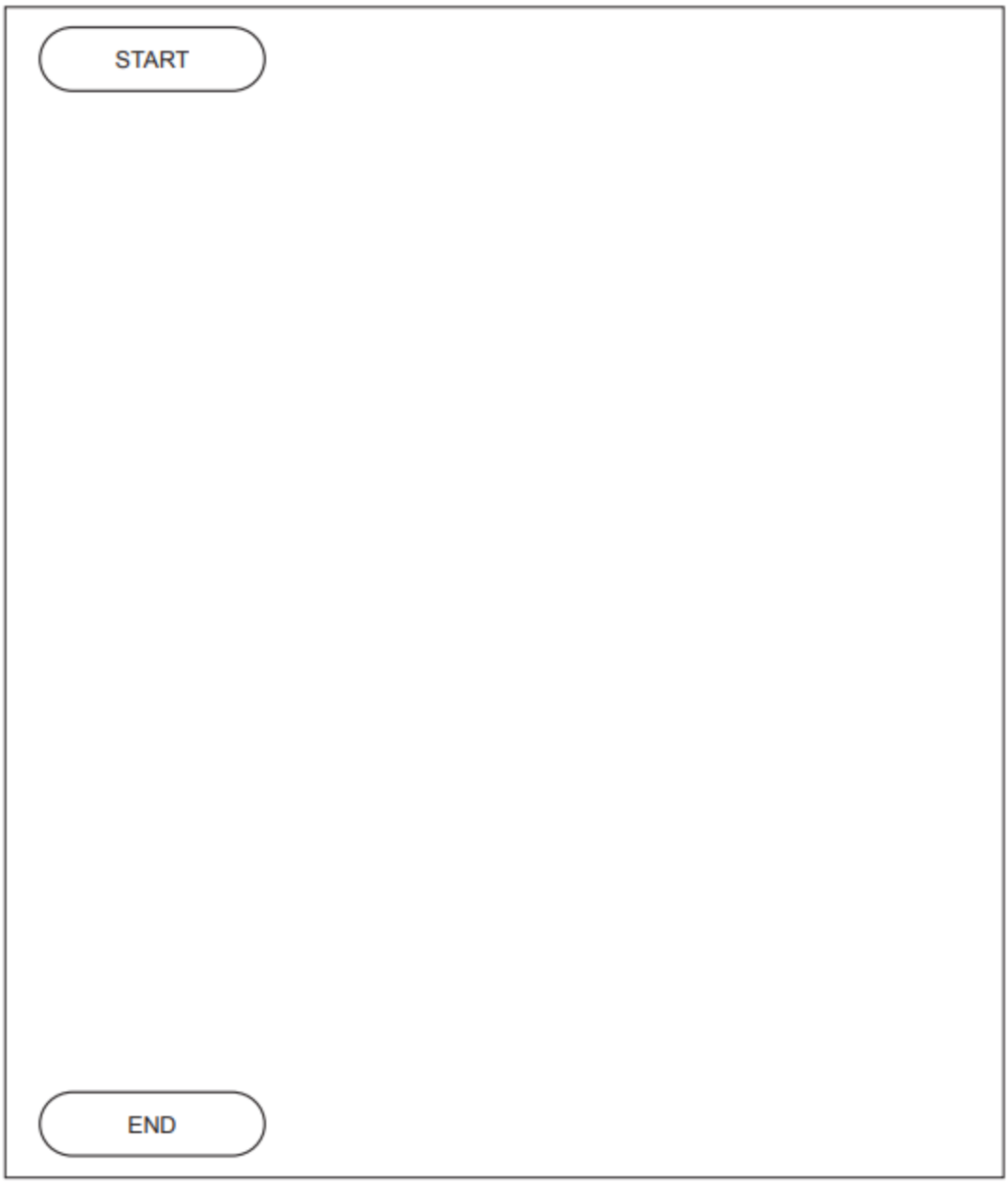
Statement	Error
`Status ← TRUE AND FALSE`	
`IF LENGTH("Password") < "10" THEN`	
`Code ← LCASE("Electrical")`	
`Result ← IS_NUM(-27.3)`	

[4]

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.

(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.

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2 .....

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3 .....

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[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]

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
`Secret[27, 1]`	"thiswebsite.com"
`Secret[27, 2]`	"••••••••••••"
`Secret[28, 1]`	"thatwebsite.com"
`Secret[28, 2]`	"••••••••••••"

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

`Exists()`	• Takes two parameters:
	  ○ a string
	  ○ a character
	• Performs a case-sensitive search for the character in the string
	• Returns `TRUE` if the character occurs in the string, otherwise returns `FALSE`

`Encrypt()`	• Takes a password as a parameter of type string • Returns the encrypted form of the password as a string
`Decrypt()`	• 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

`Exists()`	• Takes two parameters:
	  ○ a string
	  ○ a character
	• Performs a case-sensitive search for the character in the string
	• Returns `TRUE` if the character occurs in the string, otherwise returns `FALSE`

`RandomChar()`	• Generates a single random character from within one of the following ranges:
	  ○ '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'.

Describe the algorithm for `GeneratePassword()`.

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

[6]

s22 qp 23:

1 **(a)** The following table contains pseudocode examples.

Each example may include all or part of:

- selection
- iteration (repetition)
- assignment.

Complete the table by placing **one or more** ticks (✓) in each row.

Pseudocode example	Selection	Iteration	Assignment

`FOR Index ← 1 TO 3`
`  Safe[Index] ← GetResult()`
`NEXT Index`			

`OTHERWISE : OUTPUT "ERROR 1202"`			
`REPEAT UNTIL Index = 27`			
`INPUT MyName`			

`IF Mark > 74 THEN`
`  Grade ← 'A'`
`ENDIF`			

[5]

(b) (i) Program variables have values as follows:

Variable	Value
AAA	TRUE
BBB	FALSE
Count	99

Complete the table by evaluating each expression.

Expression	Evaluation
AAA AND (Count > 99)	
AAA AND (NOT BBB)	
(Count <= 99) AND (AAA OR BBB)	
(BBB AND Count > 50) OR NOT AAA	

[2]

(ii) Give an example of when a variable of type Boolean would be used.

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..... [1]

6 **(a)** The factorial of a number is the product of all the integers from 1 to that number.

For example:

factorial of 5 is given by $1 \times 2 \times 3 \times 4 \times 5 = 120$
factorial of 7 is given by $1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 = 5040$
factorial of 1 = 1

Note: factorial of 0 = 1

A function `Factorial()` will:

- be called with an integer number as a parameter
- calculate and return the factorial of the number
- return −1 if the number is negative.

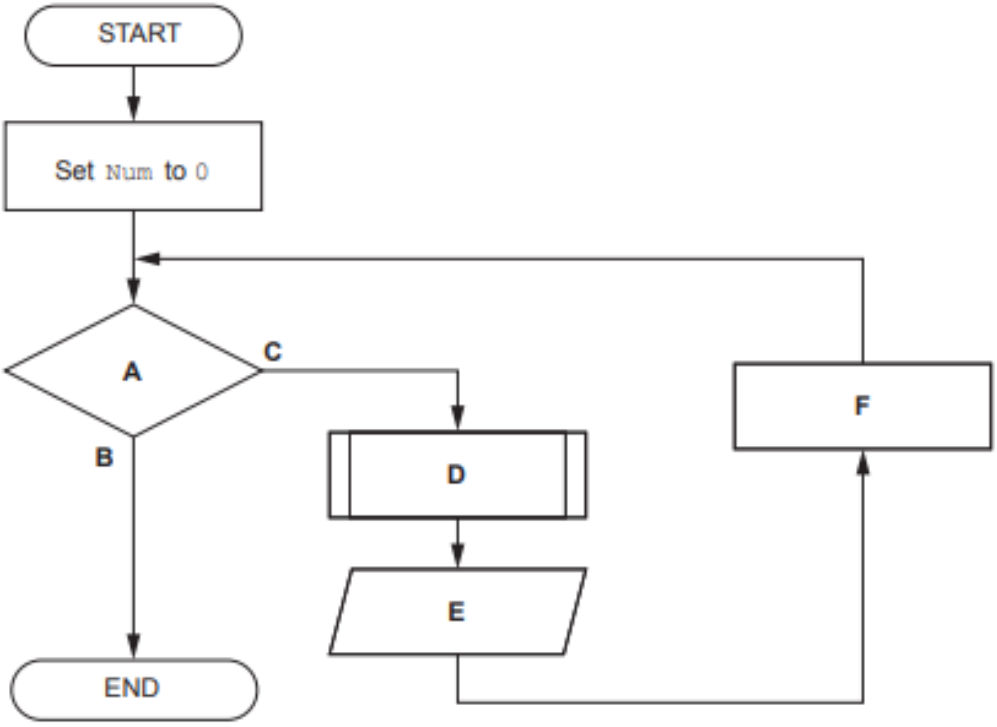
(b) A procedure `FirstTen()` will output the factorial of the numbers from 0 to 9. The procedure will use the function from **part (a)**.

The required output is:

```
Factorial of 0 is 1
Factorial of 1 is 1
Factorial of 2 is 2
```

```
Factorial of 9 is 362880
```

The program flowchart represents an algorithm for `FirstTen()`.



Complete the table by writing the text that should replace each label **A** to **F**.

Label	Text
A	
B	
C	
D	
E	
F	

[4]

w21 qp 21:

1 Sylvia is testing a program that has been written by her colleague. Her colleague tells her that the program does not contain any syntax errors.

(b) Complete the following table by giving the appropriate data type in each case.

Use of variable	Data type
The average mark in a class of 40 students	
An email address	
The number of students in the class	
To indicate whether an email has been read	

[4]

(c) An airline wants to provide passengers with information about individual flights and allow them to book their flight using an online booking system.

(i) Tick (✓) **one** box in each row of the table to indicate whether each item of information would be essential for the customer when making the booking.

Information	Essential	Not essential
Departure time		
Flight number		
Departure airport		
Aircraft type		
Ticket price		
Number of seats in aircraft		

[3]

(ii) Identify the technique used to filter out information that is not essential when designing the booking system **and** state one benefit of this technique.

Technique .....

Benefit .....

.....

[2]

(iii) Identify **two additional** pieces of essential information that a passenger might need when booking a flight.

1 .....

2 .....

[2]

2 **(a)** An algorithm to sort a 1D array into ascending order is described as follows:

- move the largest value to the end
- keep repeating until the array is sorted.

Apply the process of stepwise refinement to this algorithm in order to produce a more detailed description.

Write the more detailed description using **structured English**. Your explanation of the algorithm should not include pseudocode statements.

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..... [6]

w21 qp 22:

1 **(a)** A programmer applies decomposition to a problem that she has been asked to solve.

Describe decomposition.

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..... [2]

(c) Complete the pseudocode expressions so that they evaluate to the values shown.

Any functions and operators used must be defined in the **insert**.

Expression	Evaluates to
..... ('C')	67
2 * ..... ("27")	54
..... (27 / .....)	13
"Sub" & ..... ("Abstraction" , ... , ...)	"Subtract"

[4]

(d) Evaluate the expressions given in the following table. The variables have been assigned values as follows:

```
PumpOn ← TRUE
PressureOK ← TRUE
HiFlow ← FALSE
```

Expression	Evaluates to
`PressureOK AND HiFlow`	
`PumpOn OR PressureOK`	
`NOT PumpOn OR (PressureOK AND NOT HiFlow)`	
`NOT (PumpOn OR PressureOK) AND NOT HiFlow`	

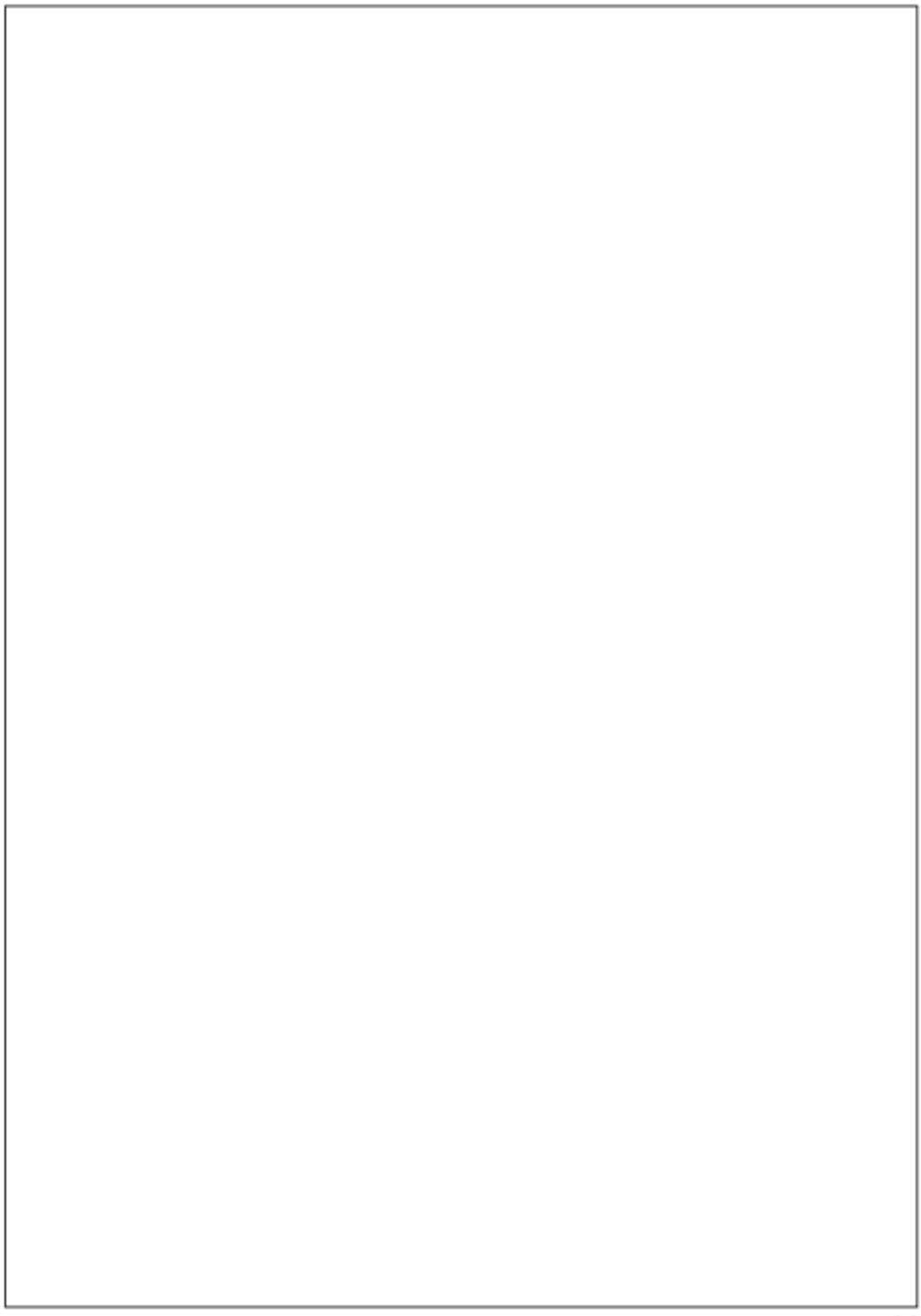
[2]

2 **(a)** An algorithm will:

1. input an integer value
2. jump to step 6 if the value is zero
3. sum and count the positive values
4. sum and count the negative values
5. repeat from step 1
6. output the two sum values and the two count values.

Draw a program flowchart on the following page to represent the algorithm.

Note that variable declarations are not required in program flowcharts.



s21 qp 21:

1 **(a)** A program is being developed to help manage the membership of a football club.

Complete the following identifier table.

Example value	Explanation	Variable name	Data type
`"Wong"`	The preferred name of the member joining the football club		
`FALSE`	A value to indicate whether an existing member of the club lives at the same address		
`19/02/1983`	When the member joined the football club		
`1345`	The number of points a member has earned. Members of the club earn points for different activities.		

[4]

(b) Each pseudocode statement in the following table may contain an error due to the incorrect use of the function or operator.

Describe 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
`Result ← 2 & 4`	
`SubString ← MID("pseudocode", 4, 1)`	
`IF x = 3 OR 4 THEN`	
`Result ← Status AND INT(x/2)`	
`Message ← "Done" + LENGTH(MyString)`	

[5]

2 **(a)** Four program modules form part of a program for a library.

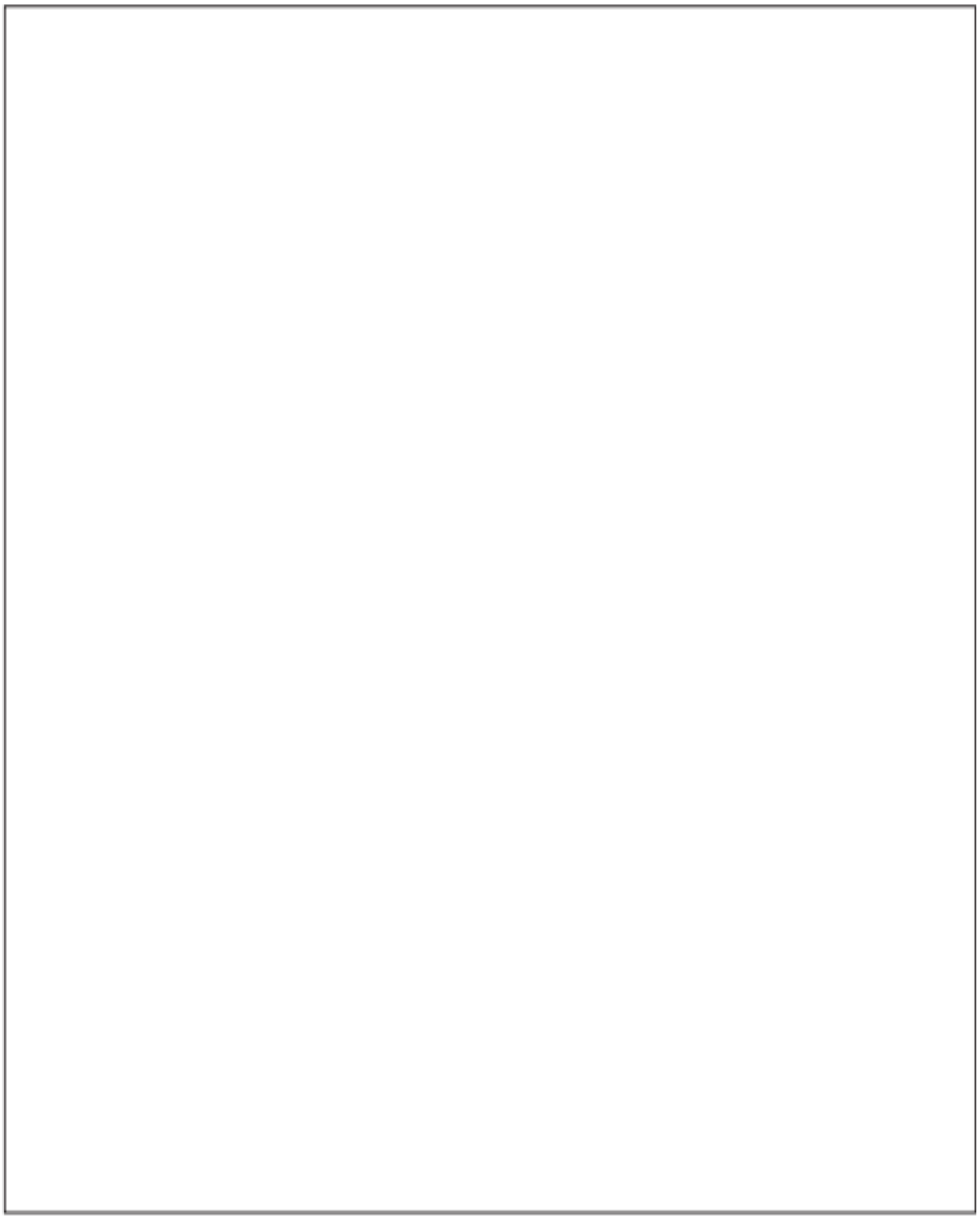
(c) A program will:

- input 50 unique integer values
- output the largest value
- output the average of the values **excluding** the largest value.

Draw a program flowchart to represent the algorithm.

Variable declarations are **not** required.

It is not necessary to check that each input value is unique.



[6]

s21 qp 22:

1 (a) (i) Complete the following table by giving the appropriate data type in each case.

Variable	Example data value	Data type
Name	"Catherine"	
Index	100	
Modified	FALSE	
Holiday	25/12/2020	

[4]

(ii) Evaluate each expression in the following table by using the initial data values shown in **part (a)(i)**.

Expression	Evaluates to
Modified OR Index > 100	
LENGTH("Student: " & Name)	
INT(Index + 2.9)	
MID(Name, 1, 3)	

[4]

(b) Each pseudocode statement in the following table contains an example of selection, assignment or iteration.

Put **one** tick ('✓') in the appropriate column for each statement.

Statement	Selection	Assignment	Iteration
Index ← Index + 1			
IF Modified = TRUE THEN			
ENDWHILE			

[3]

4 A teacher uses a paper-based system to store marks for a class test. The teacher requires a program to assign grades based on these results.

The program will output the grades together with the average mark.

Write a detailed description of the algorithm that will be needed.

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specimen paper:

1 **(a)** Program variables have values as follows:

Variable	Value
Today	"Tuesday"
WeekNumber	37
Revision	'C'
MaxWeight	60.5
LastBatch	TRUE

(i) Give an appropriate data type for each variable.

Variable	Data type
Today	
WeekNumber	
Revision	
MaxWeight	
LastBatch	

[5]

(ii) Evaluate each expression in the following table.
If an expression is invalid then write ERROR.

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

Expression	Evaluates to
MID(Today, 3, 2) & Revision & "ape"	
INT(MaxWeight + 4.2)	
LENGTH(MaxWeight)	
MOD(WeekNumber, 12)	
(Revision <= 'D') AND (NOT LastBatch)	

[5]

(b) Simple algorithms usually consist of input, process and output.

Complete the table to show if each statement is an example of input, process or output. Place one or more ticks (✓) for each statement.

Item	Statement	Input	Process	Output
1	`SomeChars ← "Hello World"`			
2	`OUTPUT RIGHT(SomeChars, 5)`			
3	`READFILE MyFile, MyChars`			
4	`WRITEFILE MyFile, "Data is " & MyChars`			

[4]