

1 (a) (i) Algorithms may be expressed using four basic constructs. One construct is sequence.

Complete the following table for two other constructs.

Construct	Pseudocode example
.....
.....

[4]

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

Complete the table by placing ticks (✓) in the relevant boxes.

Pseudocode statement	Input	Process	Output
Temp ← SensorValue * Factor			
WRITEFILE "LogFile.txt", TextLine			
WRITEFILE "LogFile.txt", MyName & MyIDNumber			
READFILE "AddressBook.txt", NextLine			

[4]

(b) Program variables have values as follows:

Variable	Value
Title	"101 tricks with spaghetti"
Version	'C'
Author	"Eric Peapod"
PackSize	4
WeightEach	6.2
Paperback	TRUE

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

For the built-in functions list, refer to the **Appendix** on page 16.

Expression	Evaluates to
MID(Title, 5, 3) & RIGHT(Author, 3)	
INT(WeightEach * PackSize)	
PackSize >= 4 AND WeightEach < 6.2	
LEFT(Author, ASC(Version) - 65)	
RIGHT(Title, (LENGTH(Author) - 6))	

[5]

(ii) Programming languages support different data types.

Give an appropriate data type for the following variables from **part (b)**.

Variable	Data type
Title	
Version	
PackSize	
WeightEach	
Paperback	

[5]

(c) White-box and black-box are two types of testing. In white-box testing, data are chosen to test every possible path through the program.

Explain how data are chosen in black-box testing.

.....
 [2]

2 (a) One type of loop that may be found in an algorithm is a count-controlled loop.

State **one other** type **and** explain when it should be used.

Type

Explanation

.....
.....

[2]

(b) Chris is asked to work on a program that has been coded in a language he is not familiar with.

He has identified that the program contains the constructs: sequence, iteration and selection.

Identify **three other** features of the program that he should expect to recognise.

Feature 1

Feature 2

Feature 3

[3]

(c) The following lines of code are taken from a program in a high-level language.

```
ON x {  
    15: Call ProcA  
    20: y := 0  
    25: y := 99  
    NONE: Call ProcError  
}
```

Identify the type of control structure **and** describe the function of the code.

Control structure

Description

.....
.....
.....

[3]

- (b) The student decides to change the algorithm and implement it as a procedure, `ScanArray()`, which will be called with three parameters.

`ScanArray(AverageValue, ZeroCount, ArrayName)`

`ScanArray()` will modify the first two parameters so that the new values are available to the calling program or module.

Write the **pseudocode** procedure header for `ScanArray()`.

.....

.....

.....

..... [4]

Question 4 begins on the next page.

- 4 The following pseudocode is a string handling function.

For the built-in functions list, refer to the **Appendix** on page 16.

```

FUNCTION Clean(InString : STRING) RETURNS STRING

    DECLARE NewString : STRING
    DECLARE Index : INTEGER
    DECLARE AfterSpace : BOOLEAN
    DECLARE NextChar : CHAR
    CONSTANT Space = ' '

    AfterSpace ← FALSE
    NewString ← ""

    FOR Index ← 1 TO LENGTH(InString)
        NextChar ← MID(InString, Index, 1)
        IF AfterSpace = TRUE
            THEN
                IF NextChar <> Space
                    THEN
                        NewString ← NewString & NextChar
                        AfterSpace ← FALSE
                    ENDIF
            ELSE
                NewString ← NewString & NextChar
                IF NextChar = Space
                    THEN
                        AfterSpace ← TRUE
                    ENDIF
            ENDIF
        ENDIF
    ENDFOR

    RETURN NewString

ENDFUNCTION

```


(iii) The pseudocode is changed so that the variable `AfterSpace` is initialised to `TRUE`.

Explain what will happen if the function is called as follows:

```
Result ← Clean("XandYandZ")
```

.....
.....
.....
..... [2]

(b) The following pseudocode declares and initialises an array.

```
DECLARE Code : ARRAY[1:100] OF STRING  
DECLARE Index : INTEGER  
  
FOR Index ← 1 TO 100  
    Code[Index] ← ""  
ENDFOR
```

The design of the program is changed as follows:

- the array needs to be two dimensional, with 500 rows and 4 columns
- the elements of the array need to be initialised to the string "Empty"

Re-write the **pseudocode** to implement the new design.

.....
.....
.....
.....
.....
.....
.....
.....
.....
..... [4]

(c) State the term used for changes that are made to a program in response to a specification change.

..... [1]

Question 5 begins on the next page.

- 5 (a) Programming languages usually contain a range of built-in functions, such as a random number generator.

State **three** advantages of using built-in functions.

1

2

3

[3]

- (b) A student is learning about random number generation.

She is investigating how many times the random function needs to be called before every number in a given series is generated.

She is using **pseudocode** to develop a procedure, `TestRand()`, which will:

- use the random number function to generate an integer value in the range 1 to 50 inclusive
- count how many times the random function needs to be called before all 50 values have been generated
- output a message giving the number of times the random function was called.

- 6 A text file, `MyCDs.txt`, stores information relating to a Compact Disc (CD) collection. Information about each CD is stored on three separate lines in the file as follows:

```
Line 1: <Artist Name>
Line 2: <CD Title>
Line 3: <Storage Location>
```

Information is stored as data strings.

A section of the file is shown:

File line	Data
100	"Green Floyd"
101	"Bowlful of Cereal"
102	"Shelf 4"
103	"Strolling Bones"
104	"Exile on Station Road"
105	"Box 12"

- (a) A program, `CDOrganiser`, will be written to manage the stored information. The program will consist of three modules: `AddCD`, `FindCD` and `RemoveCD`.

Give **three** reasons why it is good practice to construct the program using modules.

- 1
- 2
- 3

[3]

- (b) The module, `FindCD()`, will check whether a given CD exists in the collection. The module will be implemented as a function.

The function will:

- be called with two strings as parameters, representing the artist name and CD title
- return a string that gives the storage location, or an empty string if the given CD has not been found.

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Appendix

Built-in functions (pseudocode)

Each function returns an error if the function call is not properly formed.

MID(ThisString : STRING, x : INTEGER, y : INTEGER) RETURNS STRING
returns a string of length y starting at position x from ThisString

Example: MID("ABCDEFGH", 2, 3) returns "BCD"

LENGTH(ThisString : STRING) RETURNS INTEGER
returns the integer value representing the length of ThisString

Example: LENGTH("Happy Days") returns 10

LEFT(ThisString : STRING, x : INTEGER) RETURNS STRING
returns leftmost x characters from ThisString

Example: LEFT("ABCDEFGH", 3) returns "ABC"

RIGHT(ThisString : STRING, x : INTEGER) RETURNS STRING
returns rightmost x characters from ThisString

Example: RIGHT("ABCDEFGH", 3) returns "FGH"

INT(x : REAL) RETURNS INTEGER
returns the integer part of x

Example: INT(27.5415) returns 27

ASC(ThisChar : CHAR) RETURNS INTEGER
returns the ASCII value of character ThisChar

Example: ASC('A') returns 65

RAND(x : INTEGER) RETURNS REAL
returns a real number in the range 0 to x (x not inclusive).

Example: RAND(87) could return 35.43

Operators (pseudocode)

Operator	Description
&	Concatenates (joins) two strings Example: "Summer" & " " & "Pudding" produces "Summer Pudding"
AND	Performs a logical AND on two Boolean values Example: TRUE AND FALSE produces FALSE
OR	Performs a logical OR on two Boolean values Example: TRUE OR FALSE produces TRUE