

2 Data is a global 1D array containing 30 elements of type STRING

An algorithm will output:

- all non-blank elements (elements that do **not** contain an empty string)
- the final total of the number of elements output.

Complete the program flowchart to represent the algorithm:

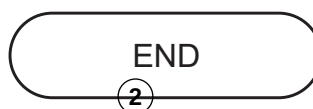


2 `Data` is a global 1D array containing 20 elements of type `REAL`

An algorithm will:

- input a sequence of real values, one at a time
- assign each value to consecutive array elements, starting from index 1
- end when the value 99.9 is input, or all 20 elements have been assigned (the value 99.9 must **not** be stored in the array).

Complete the program flowchart to represent the algorithm:



2 (a) A program contains a global 1D array of type `STRING` containing 65 elements.

An existing text file is used to store the data in the array. Only non-blank elements (those that do **not** contain an empty string) are written to the text file.

An algorithm will:

- write the first element of the array as a new line in the text file
- continue until all elements have been written, each to a new line of the text file.

Stepwise refinement is applied to the algorithm.

Describe up to **six** steps for this algorithm that could be used to produce pseudocode.

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

Step 1

.....

Step 2

.....

Step 3

.....

Step 4

.....

Step 5

.....

Step 6

.....

[6]

(b) Iteration is one programming construct.

Identify **one** other programming construct that will be required when the algorithm from part (a) is converted into pseudocode and explain how it is used.

Construct

.....

Use

.....

[2]

- 3** A student has been asked to create a simple guessing game program. This program will generate a random integer value between 1 and 100. It will then repeatedly prompt the user to input an integer value until they input the randomly generated value.

The student has written a structured English description:

step 1 – randomly generate an integer value between 1 and 100 inclusive

step 2 – prompt the user to input an integer value

step 3 – output an appropriate message if the value input was too high; then repeat from **step 2**

step 4 – output an appropriate message if the value input was too low; then repeat from **step 2**

step 5 – output an appropriate message if the value input was the same value that was randomly generated; then end the program.

Write a pseudocode algorithm from this structured English description.

Assume no input validation is needed.

[8]

2 A program to calculate the pay of employees working for a company is being designed.

(a) Stepwise refinement has been used in the design of the program.

Describe stepwise refinement.

.....

.....

.....

..... [2]

(b) One of the program modules used to calculate employees’ weekly bonus pay has been completed. The amount of bonus pay they receive is based on the number of hours worked and the value of sales made as shown in the table.

Bonus pay and value of sales are both in dollars.

Hours worked	Value of sales	Bonus pay
between 1 and 40 inclusive	2000 or less	0
between 1 and 40 inclusive	above 2000	50
above 40	2000 or less	10
above 40	above 2000	100

(i) The module is tested using white-box testing.

State **two** tests, using valid data, that can be used to test different paths through the program.

Test one:

Hours worked

Value of sales

Bonus pay

Test two:

Hours worked

Value of sales

Bonus pay

[2]

(ii) The program to calculate pay uses a number of modules which are each called from different places in the program.

The program is to be tested using stub testing before all the program modules have been completed.

Describe stub testing.

[2]

(iii) The program has been completed and compiles successfully.

The program is tested using black-box testing.

Identify and describe **one** type of error that black-box testing could detect.

Type of error	
Description	

[2]

- 3** An algorithm is designed to generate and output two unique random integers. Each integer value is between -10 and 10 inclusive.

If both integers output are negative, a third random integer between 30 and 35 inclusive will be generated and output.

Write pseudocode for this algorithm.

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.

4 An algorithm will:

- input 100 integer values, one value at a time
- store the first value input into the first location of the array `Number`
- store the next input value in the next unused location of the array `Number`
- output the contents of `Number` array in the opposite sequence to that in which the values were input.

Complete the program flowchart to represent the algorithm.

Variable declarations are **not** required.

START

END

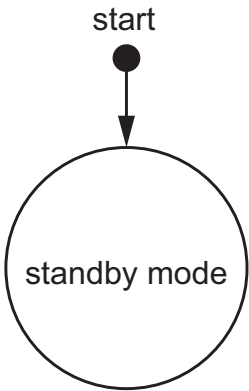
5 An automated digital camera system is used to take a sequence of pictures of animals in a garden. During the design of the system, a state-transition diagram is produced.

The table details the states in the automated digital camera system along with the events which cause the states to change.

The system starts in standby mode. The sequence of pictures is taken when in active mode.

Current state	Event	Next state
standby mode	turn on	detect mode
detect mode	turn off	standby mode
detect mode	movement detected	active mode
active mode	20 seconds elapsed	sequence complete
active mode	turn off	standby mode
sequence complete	time saved	detect mode

(a) Complete the state-transition diagram for the automated digital camera system.



(b) At the end of each sequence of pictures, the time is saved as a string in the format <HH><MM><SS> where:

- HH represents the hours using two digits
- MM represents the minutes using two digits
- SS represents the seconds using two digits.

For example:

- "081230" is stored to represent the time 8:12:30, in the morning
- "152235" is stored to represent the time 15:22:35, in the afternoon.

Each string is stored on a new line in the text file `TimeTaken.txt`

An algorithm is required to process the content of the text file `TimeTaken.txt` once it has been transferred to the computer.

For each hour when pictures are taken, output a suitable message showing the hour and the total number of sequences of pictures taken within that hour.

Example outputs:

Hour : 15 Total : 32
Hour : 18 Total : 1

Write pseudocode for this algorithm.

Assume the text file `TimeTaken.txt` contains at least **one** line.

This image shows a full page of white paper with horizontal dashed lines, typical of primary-ruled notebook paper. The lines are evenly spaced and run across the width of the page. There is no handwriting or other markings on the paper.

[8]

- 4 A programmer is developing a new stock control program for a shop owner to produce sales reports.

- (a)** A text file `Sales.txt` stores strings representing the number of items sold.

The file contains 52 lines, each representing the number of items sold in each week of the year.

For example:

File line number	File data
1	"350"
2	"502"
3	"434"
...	...
49	"492"
50	"872"
51	"772"
52	"201"

The example shows that 502 items were sold in week 2.

The owner requires a module to output all week numbers where the number of items sold is greater than 500.

Describe an algorithm that produces the required module.

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

[illegible]

(b) Once the program has been completed, it is tested using the walkthrough method.

Describe the walkthrough method and explain how it can be used to identify errors.

[3]

2 An algorithm will:

1. prompt and input a sequence of 100 integer values, one at a time
2. sum the positive integers
3. output the result of the sum.

(a) Write pseudocode for the algorithm.

Assume the value zero is neither positive nor negative.

You must declare all variables used in the algorithm.

[5]

[5]

(b) The algorithm requires the use of basic constructs. One of these is sequence.

Identify **one other** basic construct required by the algorithm **and** describe how it is used.

Construct

Use

[2]

- 4 An examination paper has a maximum of 75 marks. One of five pass grades (A to E) is assigned, depending on the mark obtained. The lowest mark for a given grade is known as the grade boundary.

A program is being written to process examination marks.

The five grade boundaries are stored in a global 1D array `GB` of type `INTEGER`, for example:

Index	Value	Comment
1	65	The minimum mark for an A grade.
2	57	The minimum mark for a B grade.
3	43	The minimum mark for a C grade.
4	35	The minimum mark for a D grade.
5	27	The minimum mark for an E grade.

Any paper that achieves a mark within 2 marks of a grade boundary must be checked. Using the given table, a paper with 45 marks would need to be checked.

- (a) The pseudocode algorithm to determine whether a paper should be checked is as shown. The mark for the paper is stored in variable `Mark`. Global variables `Mark`, `Index`, `Upper` and `Lower` are declared as integers.

Complete the pseudocode.

```

FOR Index ← 1 TO .....
    Lower ← GB[Index] - 2
    Upper ← .....
    IF Mark ..... AND Mark ..... THEN
        OUTPUT "Check this paper"
    ENDIF
NEXT Index

```

[4]

- (b) An alternative algorithm to determine if a paper needs to be checked uses a global 1D array `Check`, containing 76 elements of type `BOOLEAN`. The indices of the array are from 0 to 75 (inclusive), corresponding to the range of possible marks.

An element value in `Check` is `TRUE` if the index is within 2 marks of a grade boundary. For example, in the case where the C grade boundary is 43 the corresponding part of the `Check` array would be as follows:

Index	Value
40	FALSE
41	TRUE
42	TRUE
43	TRUE
44	TRUE
45	TRUE
46	FALSE

← The grade boundary for a C grade

- (i) The mark for a given paper is stored in variable `Mark`.

Describe how an algorithm would use the `Check` array to determine whether this paper should be checked.

..... [2]

- (ii) A procedure `GBInitialise()` will initialise the `Check` array using values from the `GB` array.

Note it can be assumed that the maximum grade boundary value for A is 70 and the minimum value for E is 15.

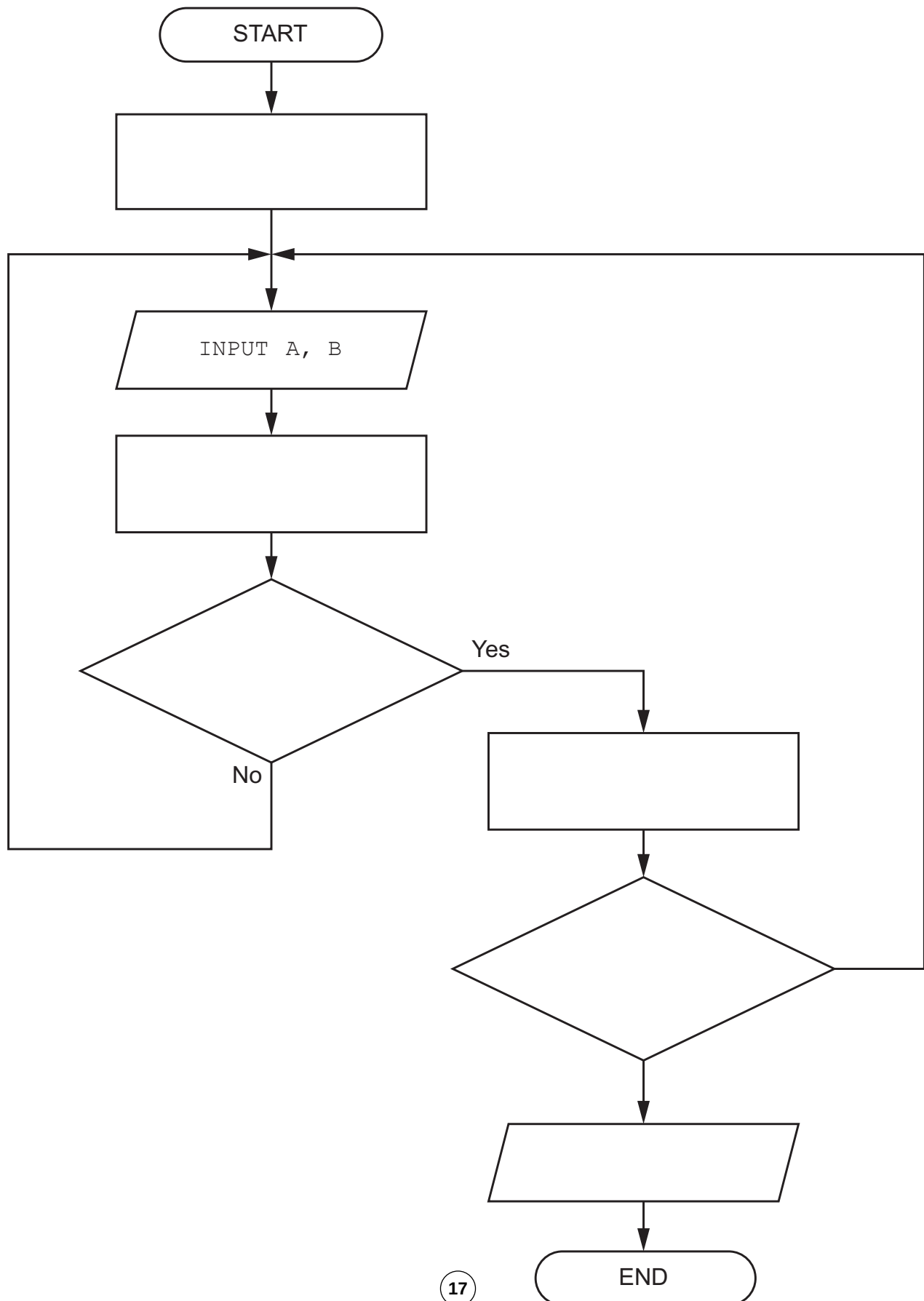
Write pseudocode for the procedure.

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

2 An algorithm has three steps. It will:

1. repeatedly input a pair of numeric values A and B
2. count the number of pairs that are input until A has been greater than B 10 times
3. output the number of pairs that were input.

(a) Complete the program flowchart.



(b) Step 1 of the algorithm is changed.

A variable `ThisSequence` is used to enter a sequence of 10 pairs of numeric values, using a single input statement.

Following the input of `ThisSequence` the revised algorithm will extract the pairs of numbers.

Describe the variable `ThisSequence` and how the numbers are extracted.

[2]