Week 23

IGCSE Computer Science

Homework bundle for this week

本周作业合集

exercises.lol

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8. Programming

Starter Quiz · 课前小测

IGCSE Computer Science Name: _____ Score: _____

1. What is the difference between a variable and a constant?

   ☐ a variable can change while the program runs; a constant is fixed

   ☐ a constant can change; a variable is fixed

   ☐ they are the same

   ☐ a variable cannot hold a number

2. What is ‘17 MOD 5‘?

   _____

3. An array is:

   ☐ one variable that holds many values of the same type, found by an index

   ☐ a single value

   ☐ several variables of different types

   ☐ a file on disk

4. Which structure chooses which steps to run based on a condition?

   ☐ selection (IF / CASE)

   ☐ sequence

   ☐ iteration

   ☐ a procedure

5. What is ‘17 DIV 5‘?

   _____

6. In ‘grid[2, 3]‘, which cell is accessed?

   ☐ row 2, column 3

   ☐ row 3, column 2

   ☐ the 23rd element

   ☐ column 2 only

7. A WHILE loop tests its condition before the body (so it may run zero times), while a REPEAT...UNTIL loop tests after the body (so it always runs at least once).

   ☐ True ☐ False

8. What does ‘LENGTH(”Computer”)‘ return?

   _____

9. You should always close a file when you have finished using it.

   ☐ True ☐ False

10. Which line keeps a running total?

    ☐ total ← total + value

    ☐ count ← count + 1

    ☐ total ← 0

    ☐ OUTPUT total

IGCSE Computer Science

1. **a variable can change while the program runs; a constant is fixed**

   A variable's value can change; a constant is set once and never changes.

2. **2**

   MOD gives the remainder: $17 \div 5 = 3$ remainder 2.

3. **one variable that holds many values of the same type, found by an index**

   An array stores many same-type values under one name; each is accessed by its index.

4. **selection (IF / CASE)**

   Selection branches on a condition; sequence runs in order; iteration repeats.

5. **3**

   DIV gives the whole-number part: $17 \div 5 = 3$ (remainder discarded).

6. **row 2, column 3**

   The first index is the row, the second the column — row 2, column 3.

7. **True**

   Pre-condition (WHILE) can skip entirely; post-condition (REPEAT) always runs once — choose by whether the body must run at least once.

8. **8**

   "Computer" has 8 characters.

9. **True**

   Closing saves any buffered data and frees the file for other programs.

10. **total ← total + value**

    'total ← total + value' accumulates the sum; 'count ← count + 1' counts occurrences.

IGCSE COMPUTER SCIENCE • EXERCISE SHEET

8.1 Programming concepts

Name: _____ Class: _____ Date: _____ **Total: 36 marks**

KEY WORDS variable 变量 • output 输出 • input 输入 • function 函数 • procedure 过程

Objective

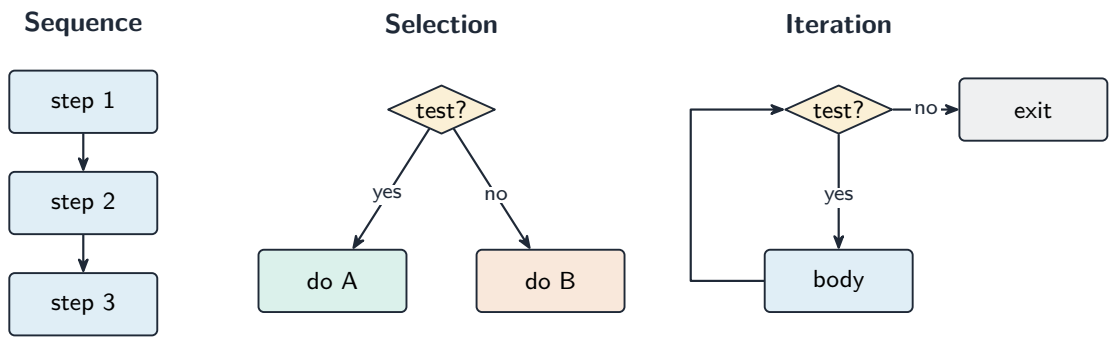
Build the skills to answer exam questions on **programming concepts** 编程概念 — variables, data types, the three control structures (**sequence, selection, iteration** 顺序、选择、迭代), operators, and procedures/functions.

You must be able to:

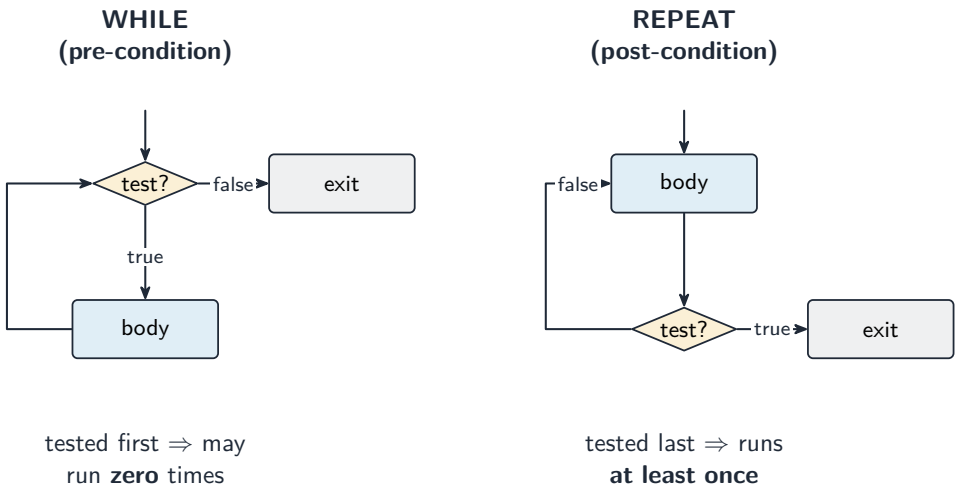
- declare variables/constants and use the five data types
- use sequence, selection (IF/CASE) and iteration (FOR/WHILE/REPEAT)
- use operators (MOD, DIV) and write procedures/functions

1 Worked examples

Control structures



Sequence runs steps in order; selection chooses a branch; iteration repeats a body



A WHILE loop may run 0 times; a REPEAT loop runs at least once

- `17 MOD 5` = `2` (remainder); `17 DIV 5` = `3` (whole part).

■ Declaring, choosing and repeating

Declarations. A **variable** 变量 has a value that can change while the program runs; a **constant** 常量 is set once and never changes. In Cambridge pseudocode:

```
DECLARE Total : INTEGER
DECLARE Name  : STRING
CONSTANT VAT = 0.20
```

The five data types are `INTEGER` (whole numbers), `REAL` (numbers with a decimal part), `CHAR` (one character), `STRING` (text) and `BOOLEAN` (`TRUE` or `FALSE`).

Selection. `IF … THEN … ELSE … ENDIF` chooses between two paths; `CASE OF … OTHERWISE … ENDCASE` is neater when one variable is tested against many values.

Iteration, and how to choose:

Loop	When to use it	Runs at least once?
`FOR … TO … NEXT`	the number of repeats is known (count-controlled)	no, if the range is empty
`WHILE … DO … ENDWHILE`	the condition is tested **before** the body	no
`REPEAT … UNTIL`	the condition is tested **after** the body	yes

Worked example (count-controlled total).

```
DECLARE Total : INTEGER
DECLARE Mark  : INTEGER
DECLARE Count : INTEGER
Total ← 0
FOR Count ← 1 TO 10
    OUTPUT "Enter mark"
    INPUT Mark
    Total ← Total + Mark
NEXT Count
OUTPUT "The total is ", Total
```

Every mark in a "write pseudocode" question is earned by one of these: declaring and initialising, a correctly formed loop with the right count, the input inside the loop, the running total updated correctly, and a sensible output after the loop.

Operators. `MOD` gives the remainder and `DIV` the whole number of divisions: `17 MOD 5` is `2` and `17 DIV 5` is `3`. Together they split a value, for example turning 137 seconds into 137 DIV 60 = 2 minutes and 137 MOD 60 = 17 seconds.

Procedures and functions. Both are named blocks of code that can be called from anywhere, which avoids repeating code. A **function** 函数 returns a value to the line that called it, so it is used inside an expression; a **procedure** 过程 does not return a value.

2 Practice

2.1 State the difference between a variable and a constant. [2]

2.2 Give the value of `23 MOD 4`. [1]

2.3 Give the pseudocode declaration for a variable that stores a student's name, and a constant for a tax rate of 0.2. [2]

2.4 Identify the data type you would use for each of: a price, whether a box is ticked, a single grade letter. [3]

2.5 Explain the difference between a WHILE loop and a REPEAT loop. [2]

3 Exam-style questions

3.1 A loop that always runs **at least once** is a: [1]

- **A** FOR loop
- **B** WHILE (pre-condition) loop
- **C** REPEAT (post-condition) loop
- **D** CASE statement

3.2 A program reads 10 marks and outputs their total.

(a) State which control structure repeats the input 10 times. [1]

(b) Write pseudocode using a count-controlled loop to total 10 input marks. [4]

3.3 State the difference between a procedure and a function. [2]

3.4 A program records the times, in whole seconds, taken by 20 runners.

(a) Complete the pseudocode declarations for the total, one runner's time and the loop counter. [3]

(b) Write pseudocode that inputs the 20 times, adds them to a total, and outputs the average. [6]

(c) The program must also output the fastest time. Describe, in words, the extra steps needed inside the loop. [3]

(d) A time of 137 seconds must be shown as minutes and seconds. Give the two expressions, using MOD and DIV, and state the values they produce. [3]

(e) The conversion in part (d) is needed in three places in the program. Explain why writing it as a function is better than repeating the code, and state what a function does that a procedure does not. [3]

Solutions

2.1 a variable's value can change while the program runs; a constant's value is fixed.

2.2 `3`.

2.3 `DECLARE Name : STRING`; `CONSTANT TaxRate = 0.2`.

2.4 Price: `REAL`; whether a box is ticked: `BOOLEAN`; a single grade letter: `CHAR`.

2.5 A WHILE loop tests the condition before the body, so the body may run zero times; a REPEAT loop tests after the body, so it always runs at least once.

3.1 C. A REPEAT (post-condition) loop runs at least once.

3.2 (a) iteration (a count-controlled / FOR loop).
(b) `total ← 0`; `FOR i ← 1 TO 10`; `INPUT mark` then `total ← total + mark`; `NEXT i` then `OUTPUT total`.

3.3 a function returns a value to where it was called; a procedure does a task but returns no value.

3.4 (a) `DECLARE Total : INTEGER`, `DECLARE Time : INTEGER`, `DECLARE Count : INTEGER`.
(b) `Total ← 0` before the loop; `FOR Count ← 1 TO 20` with `NEXT Count`; `INPUT Time` inside the loop; `Total ← Total + Time` inside the loop; `Average ← Total / 20` after the loop; `OUTPUT Average`.
(c) Set a variable, say `Fastest`, to the first time (or to a very large value) before the loop; inside the loop compare each new time with `Fastest`; if the new time is smaller, replace `Fastest` with it, and output `Fastest` after the loop.
(d) `137 DIV 60` gives 2 minutes; `137 MOD 60` gives 17 seconds; so the time is displayed as 2 minutes 17 seconds.
(e) The code is written once and called three times, so the program is shorter and a correction only has to be made in one place; it is also easier to read and test. A function returns a value to the line that called it, so it can be used inside an expression, while a procedure does not return a value.

Name:

IGCSE Computer Science: **w25 21**

3 Tick (✓) **one** box to identify the operator that returns the quotient of a calculation with the fractional part discarded.

A `/` ☐

B `DIV` ☐

C `^` ☐

D `MOD` ☐

[1]

IGCSE Computer Science: **w25 22**

1 Tick (✓) **one** box to complete this sentence.

The result of the arithmetic operation 4 ^ 2 is

A 2 ☐

B 8 ☐

C 16 ☐

D 42 ☐

[1]

IGCSE Computer Science: **w25 23**

3 Tick (✓) **one** box to identify the most appropriate data type to store `'M'`

A integer ☐

B char ☐

C real ☐

D Boolean ☐

[1]

Name: IGCSE Computer Science: **s25 21**

5 Two library routines used in programming are MOD and DIV.

State the purpose of each of the library routines.
Give **one** example pseudocode statement for each of the library routines.

MOD purpose .....

.....

Example pseudocode .....

.....

DIV purpose .....

.....

Example pseudocode .....

.....

[4]

IGCSE Computer Science: **w24 22**

2 Tick (✓) **one** box to complete this sentence.

A pseudocode example of a selection statement is

A `CALL Sorting(Value1, Value2)` ☐

B `DECLARE Count : INTEGER` ☐

C `IF X = 7 THEN Y ← 21 ENDIF` ☐

D `WHILE X <> -1 DO` ☐

[1]

IGCSE Computer Science: **s24 21**

3 State what is meant by the data types integer and real.
Give an example of each.

Integer .....

.....

Example .....

Real .....

.....

Example .....

[4]

5 A high-level programming language makes use of arithmetic, Boolean and logical operators.

State how each type of operator is used.
Give an example statement, in pseudocode, for each one.

Arithmetic .....

.....

Example .....

.....

Boolean .....

.....

Example .....

.....

Logical .....

.....

Example .....

.....

[6]

3 Describe the characteristics of the string and char data types and give an example of each.

String .....

.....

Example .....

Char .....

.....

Example .....

[4]

7 **(a)** The string operation `SUBSTRING(FullText, X, Y)` returns a string from `FullText` beginning at position `X` that is `Y` characters long. The first character in `FullText` is in position 1.

Write the pseudocode statements to:

- store the string “IGCSE Computer Science at Cambridge” in `FullText`
- extract and display the words “Computer Science” from the string and store it in a suitable variable
- output the original string in upper case.

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..... [4]

(b) Write the pseudocode statements to:

- store the content of the variable you created in part **(a)** to a text file named `"Subjects.txt"`
- close the text file at the end of the algorithm.

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..... [3]

6 Describe **two** types of iteration that a programmer can use whilst writing a program.

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..... [4]

5 Explain how variables and constants should be used when creating and running a program.

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..... [3]

8 Explain why a programmer would use procedures and parameters when writing a program.

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..... [4]

IGCSE COMPUTER SCIENCE • EXERCISE SHEET

8.2 Arrays

Name: _____ Class: _____ Date: _____ **Total: 33 marks**

KEY WORDS two-dimensional (2d) 二维 • one-dimensional (1d) 一维 • a one-dimensional array 一维数组 • a two-dimensional array 二维数组 • arrays 数组

Objective

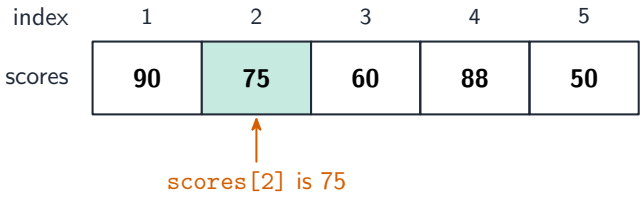
Build the skills to answer exam questions on **arrays** 数组 — declaring and using **one-dimensional (1D)** 一维 and **two-dimensional (2D)** 二维 arrays, and using a loop to fill or read them.

You must be able to:

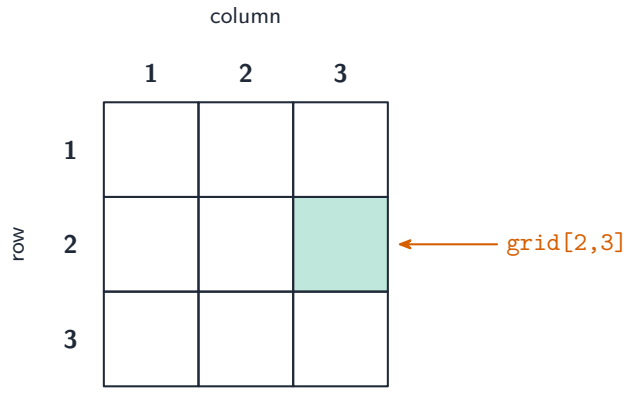
- declare a 1D and a 2D array and use an **index** 索引 to read/write a value
- use a loop (and a nested loop) to process an array
- choose between a 1D and a 2D array for a problem

1 Worked examples

■ 1D and 2D arrays



A 1D array is a list; each value is found by one index



A 2D array is a table; each value is found by two indexes [row, column]

- 1D: `DECLARE scores : ARRAY[1:5] OF INTEGER`, then `scores[2] ← 75`.
- 2D: `DECLARE grid : ARRAY[1:3, 1:3] OF INTEGER`, then `grid[2, 3] ← 8`.

Arrays, files, and the tests that find the bugs

A one-dimensional array 一维数组 is a list of values under one name, each reached by an index: `DECLARE Scores : ARRAY[1:10] OF INTEGER`, so `Scores[3]` is the third value. **A two-dimensional array** 二维数组 is a table with a row and a column index: `DECLARE Grid : ARRAY[1:5, 1:4] OF STRING`, so `Grid[2,3]` is row 2, column 3. Use a nested loop to work through a 2D array: the outer loop over rows, the inner over columns.

Reading and writing a file in Cambridge pseudocode:

```
OPENFILE "Marks.txt" FOR WRITE
WRITEFILE "Marks.txt", Name
CLOSEFILE "Marks.txt"

OPENFILE "Marks.txt" FOR READ
READFILE "Marks.txt", Line
CLOSEFILE "Marks.txt"
```

Always close a file: leaving it open can lose the data that has not yet been written.

Validation 验证 checks that the data is **sensible** as it is entered, and the computer can do it: a **range check** (is the mark between 0 and 100?), a **length check** (is the password at least 8 characters?), a **type check** (is it a whole number?), a **presence check** (was anything entered?), a **format check** (does the date look like DD/MM/YYYY?), and a **check digit** (does the extra digit match a calculation on the others?).

Verification 校验 checks that the data has been **copied correctly**: **double entry** (type it twice and compare) or a **visual check** (read it against the original).

Test data. For a mark out of 100: **normal** data such as 45 is accepted; **abnormal** data such as `-5` or `A` is rejected; **extreme** (boundary) data such as 0 and 100 is

accepted, while 101 is rejected. Write a test plan as a table of the value, the reason for choosing it and the expected result.

Worked example. State one validation and one verification check for a password, with a reason. Validation: a length check that the password is at least eight characters, because a short password is easily guessed. Verification: double entry, typing it twice and comparing, because a typing mistake would lock the user out of their own account.

2 Practice

2.1 An array is declared `DECLARE temps : ARRAY[1:7] OF REAL`. State how many values it can hold. [1]

2.2 State one difference between a 1D and a 2D array. [2]

2.3 Give the pseudocode declaration for an array holding 20 real numbers. [2]

2.4 Identify the type of validation check for each: a date entered as DD/MM/YYYY; an age between 0 and 120; a name box that must not be left empty. [3]

2.5 Explain the difference between validation and verification. [2]

3 Exam-style questions

3.1 Which data structure best stores the marks of 30 students in **one** subject? [1]

- **A** a single variable
- **B** a 1D array
- **C** a 2D array
- **D** a constant

3.2 An array `names` holds 5 names in elements 1 to 5.

(a) Write pseudocode to output every name using a loop. [3]

(b) State which type of array (1D or 2D) you would use to store the marks of 30 students in **5** subjects, and why. [2]

3.3 A program stores the marks of 30 students in a one-dimensional array called `Marks`, out of a maximum of 100.

(a) Write the pseudocode declaration for the array. [2]

(b) Write pseudocode that inputs 30 marks into the array, rejecting any mark that is not between 0 and 100 and asking again. [6]

(c) Complete the test plan by giving one value of each type and the expected result. [3]

Type of test data	Value	Expected result
normal		
abnormal		
extreme		

(d) The marks are then written to a file. Write the three lines of pseudocode that open the file for writing, write `Marks[1]` and close it. [3]

(e) Explain why the file must be closed. [1]

(f) The teacher's name is typed twice when the program starts. Identify this check and explain its purpose. [2]

Solutions

2.1 7.

2.2 a 1D array is a single list using one index; a 2D array is a table using two indexes [row, column].

2.3 `DECLARE Numbers : ARRAY[1:20] OF REAL`.

2.4 Format check; range check; presence check.

2.5 Validation checks that the data entered is sensible or reasonable, and the computer performs it automatically; verification checks that the data has been copied or entered accurately compared with the original.

3.1 B. One subject = a single list = a 1D array.

3.2 (a) `FOR i ← 1 TO 5`; `OUTPUT names[i]`; `NEXT i`.
(b) a 2D array; because each student needs 5 marks, so two indexes [student, subject] are required.

3.3 (a) `DECLARE Marks : ARRAY[1:30] OF INTEGER`.
(b) `FOR Count ← 1 TO 30` with `NEXT Count`; a loop that repeats the input while the value is out of range, such as `REPEAT … UNTIL Mark >= 0 AND Mark <= 100`; `INPUT Mark` inside that loop; an error message when the value is rejected; `Marks[Count] ← Mark` inside the outer loop.
(c) Normal: 45, accepted. Abnormal: −5 or `A`, rejected with an error message. Extreme: 0 or 100, accepted; 101, rejected.
(d) `OPENFILE "Marks.txt" FOR WRITE`; `WRITEFILE "Marks.txt", Marks[1]`; `CLOSEFILE "Marks.txt"`.
(e) Data still held in memory may not have been written to the disc, so closing the file makes sure it is saved.
(f) Double entry, a verification check; it catches a typing mistake, because a slip is unlikely to be repeated identically the second time.

11 The scores for each competitor in an archery competition are recorded.

The one-dimensional (1D) array `CompetitorName[]` is used to store the names of the competitors.

The maximum number of competitors is 30.

There are 10 rounds in the competition with a maximum score of 30 per round.

The two-dimensional (2D) array `CompetitorScore[]` stores the score in each of the 10 rounds for each competitor.

The first index of the array `CompetitorScore[]` is the same as the index of the competitor in `CompetitorName[]`

After the 10 rounds have been completed, the highest score and the lowest score for each competitor are discarded.

The overall score for each competitor is the total of the remaining 8 scores (after discarding the highest and lowest scores) .

A competitor with an overall score of 210 or more moves onto the next competition. A competitor with an overall score between 180 and 209 inclusive becomes a reserve competitor. A competitor with an overall score below 180 does not qualify.

Write a program that meets the following requirements:

- inputs the total score (out of 30) for each competitor in each round
- validates each input is between 0 and 30 inclusive
- calculates the overall score for each competitor discarding the highest and lowest scores
- outputs the name of each competitor and if they move onto the next competition, are a reserve or do not qualify
- calculates and outputs the number of competitors who:
  - have qualified for the next competition
  - are reserve competitors
  - do **not** qualify.

You must use pseudocode or program code **and** add comments to explain how your code works.

You do **not** need to declare any arrays or variables; assume that this has already been done.

All inputs and outputs must contain suitable messages.

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..... [15]

2 This pseudocode algorithm is intended to input a first name from a user and search for it in a two-dimensional (2D) array. If the name is found, the algorithm outputs all the remaining details for that name. The algorithm will continue to allow other names to be entered for searching, until the user input stops it.

```
01 DECLARE Contacts : ARRAY[1:500, 1:4] OF REAL
02 DECLARE Row : INTEGER
03 DECLARE Column : INTEGER
04 DECLARE Continue : BOOLEAN
05 DECLARE Stop : BOOLEAN
06 DECLARE FirstName : STRING
07 Continue ← TRUE
08 Stop ← FALSE
09 WHILE Continue
10     Row ← 1
11     OUTPUT "Enter a first name "
12     OUTPUT FirstName
13     REPEAT
14         IF Contacts[Row, 1] = FirstName
15           THEN
16             FOR Column ← 1 TO 4
17                 OUTPUT Contacts[Row, 1]
18             NEXT Column
19             Stop ← TRUE
20           ELSE
21             Row ← Row + 1
22         ENDIF
23     NEXT Stop OR Row > 500
24     OUTPUT "Search for another name? (Y or N)"
25     INPUT Answer
26     IF Answer = 'N' OR Answer = 'n'
27       THEN
28         Continue ← TRUE
29     ENDIF
30 ENDWHILE
```

(a) Identify the line numbers of **five** errors in the pseudocode and suggest a correction for each error.

Error 1 line number .....

Correction .....

....

Error 2 line number .....

Correction .....

.....

Error 3 line number .....

Correction .....

.....

Error 4 line number .....

Correction .....

.....

Error 5 line number .....

Correction .....

.....

[5]

(b) A procedure `NewData` allows data for new contacts to be entered and stored in the 2D array `Contacts[]`. A parameter, `Number`, is used to pass values from the main algorithm to the procedure for the number of new contacts. Next, four pieces of contact data for each new contact are entered and stored at the start of the array.

(i) Complete the pseudocode for `PROCEDURE NewData`

```
PROCEDURE NewData(.....)
    FOR Row ← 1 TO .....
        FOR Column ← 1 TO 4
            INPUT .....
            .....
        .....
ENDPROCEDURE
```

[4]

(ii) Write the pseudocode to input the number of new contacts and to use procedure `NewData`. A variable declaration is **not** required.

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[2]

(c) A first name is used as the search key in the algorithm on page 2. If the name is found, all the data for that name is output and the algorithm stops searching.

(i) Explain why the given algorithm may **not** always give the expected results.

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..... [2]

(ii) Explain how you could improve the algorithm so that the search is more likely to find the required results.

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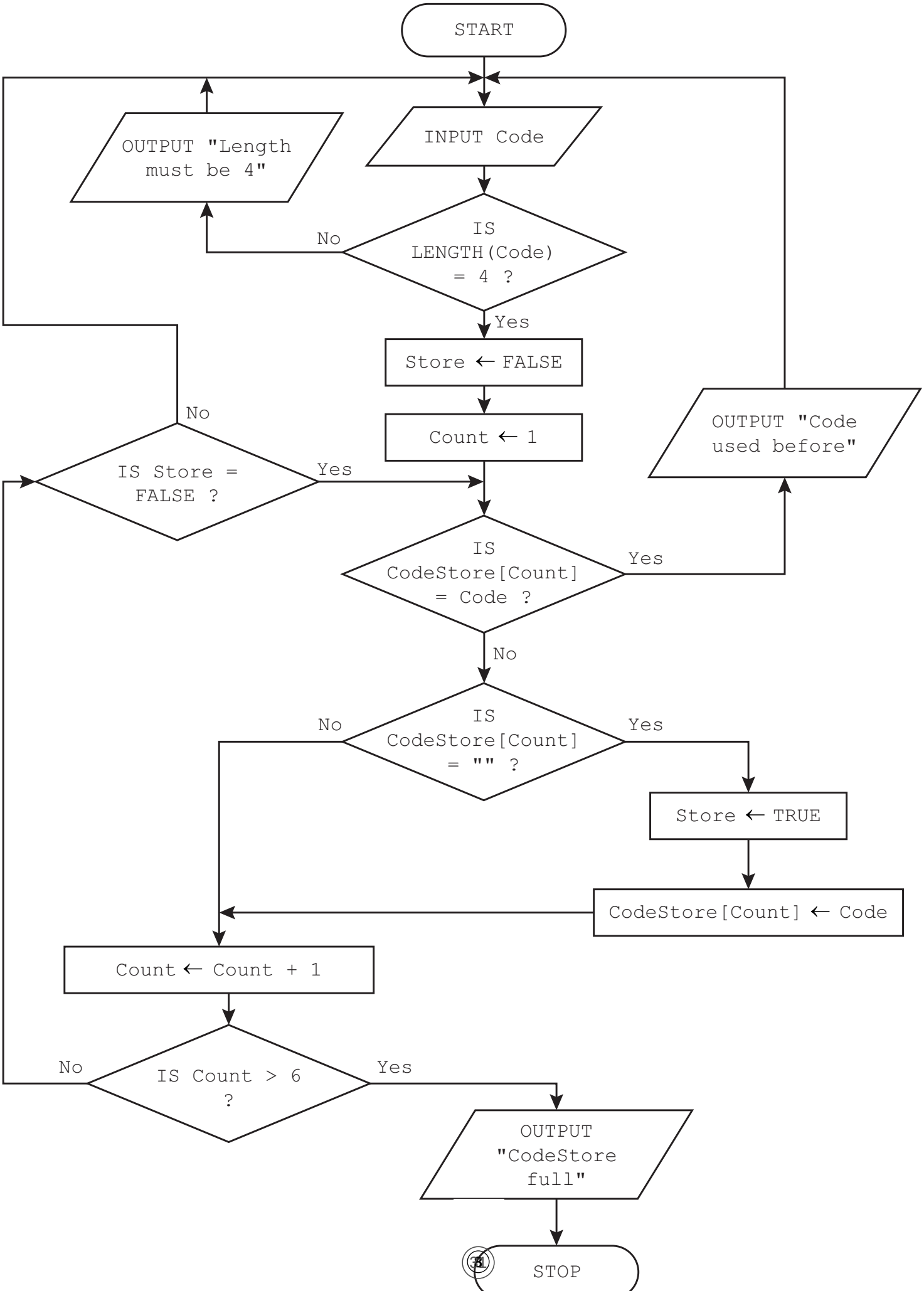
..... [2]

5 This flowchart represents an algorithm.



(a) The first data row of the trace table shows the values currently stored in `CodeStore[]`

Complete the trace table for the algorithm, using the input data:

7686, Face, Speed, 432U, Yp79

			CodeStore[]						
Code	**Store**	**Count**	**[1]**	**[2]**	**[3]**	**[4]**	**[5]**	**[6]**	**OUTPUT**
			aBcd	1532	Face	63q8			

[6]

(b) Describe the processes in the algorithm on page 6.

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..... [3]

(c) The algorithm on page 6 requires the array `CodeStore[]` to be declared as a one-dimensional (1D) string array with six elements that are initially set to the null string `""`.

Write the pseudocode required to declare and initialise the array `CodeStore[]`
You do need to declare any variables used.

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..... [4]

3 The following pseudocode algorithm uses a count-controlled loop to read in 10 names and store them in the array `Names[]`

```
FOR Count ← 1 TO 10
    OUTPUT "Please enter a name"
    INPUT Name
    Names[Count] ← Name
NEXT Count
```

Rewrite the algorithm in pseudocode, using a condition-controlled loop instead of a count-controlled loop.

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..... [4]

3 The purpose of this pseudocode algorithm is to carry out a bubble sort to sort, in descending order, 1000 numbers stored in a one-dimensional (1D) array.

```
01 DECLARE Values : ARRAY[1:1000] OF REAL
02 DECLARE Index : CHAR
03 DECLARE Stop : BOOLEAN
04 DECLARE Hold : REAL
05 Stop ← FALSE
06 WHILE NOT Stop DO
07     Stop ← FALSE
08     FOR Index ← 1 TO 50
09         IF Values[Index + 1] > Values[Index]
10           THEN
11             Hold ← Values[Index]
12             Values[Index] ← Values[Index + 1]
13             Values[Index + 1] ← Hold
14             Stop ← FALSE
15         ENDIF
16     NEXT Index
17 NEXT Stop
```

(a) Identify the line numbers of **four** errors in the pseudocode and suggest a correction for each error.

Error 1 line number .....

Correction .....

.....

Error 2 line number .....

Correction .....

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Error 3 line number .....

Correction .....

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Error 4 line number .....

Correction .....

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[4]

(b) The swap section in lines 11 to 13 of the existing code are to be changed to a call statement for a procedure. This procedure will include two parameters representing the indexes of the array elements to be swapped.

(i) Complete the pseudocode for `PROCEDURE Swap`

```
PROCEDURE Swap(.....)
    DECLARE Hold : REAL
    Hold ← Values[.....]
    .....
    .....
ENDPROCEDURE
```

[4]

(ii) Write the pseudocode to transfer control to `PROCEDURE Swap`

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..... [2]

(c) Explain the difference between global variables and the variable declared in **3(b)(i)**.

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..... [2]

12 A one-dimensional (1D) array `Rooms[]` contains the names of up to 20 rooms in a house.
A two-dimensional (2D) array `Dimensions[]` is used to store the length, width and area of each room.

The position of any room's data is the same in both arrays. For example, the data in index 5 of `Dimensions[]` belongs to the room in index 5 of `Rooms[]`

The variable `Number` stores the number of rooms for which data is to be input. There must be at least 3 rooms but no more than 20.

Write a program that meets the following requirements:

- allows the number of rooms for which data is required to be input, stored and validated
- allows the name of the room and the length and width of the room, in metres, to be entered and stored
- allows the area of each room to be calculated as length multiplied by width and stored as square metres rounded to two decimal places
- calculates the average size of all the rooms by area, in square metres, rounded to two decimal places
- finds the largest room and smallest room by area
- outputs the names of all rooms with their dimensions and area
- outputs the names of the largest room and smallest room by area
- outputs the total area of the house and the average size of all the rooms by area.

You must use pseudocode or program code **and** add comments to explain how your code works.

You do **not** need to declare any arrays or variables; you may assume that this has already been done.

All inputs and outputs must contain suitable messages.

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[15]

10 The one-dimensional (1D) array `Clubs[]` is used to store the names of 12 cricket clubs in a local sports league.

The two-dimensional (2D) array `Statistics[]` is used to store, for each cricket club, the number of:
- matches won
- matches drawn
- matches lost.

The 1D array `Points[]` is used to store the total number of points each cricket club has been awarded.

The position of any cricket club's data is the same in all three arrays. For example, the data in index 2 of `Statistics[]` and index 2 of `Points[]` belongs to the cricket club in index 2 of `Clubs[]`

The variable `Matches` stores the number of matches played by each team. Each team plays the same number of matches.

Points are awarded for:
- a win – 12 points
- a draw – 5 points
- a loss – 0 points.

Write a program that meets the following requirements:
- allows the number of matches played to be input and stored, with a maximum of 22 matches
- validates the number of matches played
- allows the names of the cricket clubs to be input and stored
- allows the number of matches won, drawn and lost to be input and stored for each team
- validates the number of matches won, drawn or lost against the number of matches played
- asks the user to re-enter the number of matches won, drawn or lost if the total does not match the number of matches played
- calculates and stores the total number of points for each club
- finds the cricket club or clubs with the highest number of points
- outputs the name or names of the winning club or clubs, the number of wins and the total number of points awarded.

You must use pseudocode or program code **and** add comments to explain how your code works.

You do **not** need to declare any arrays or variables; you may assume that this has already been done.

All inputs and outputs must contain suitable messages.

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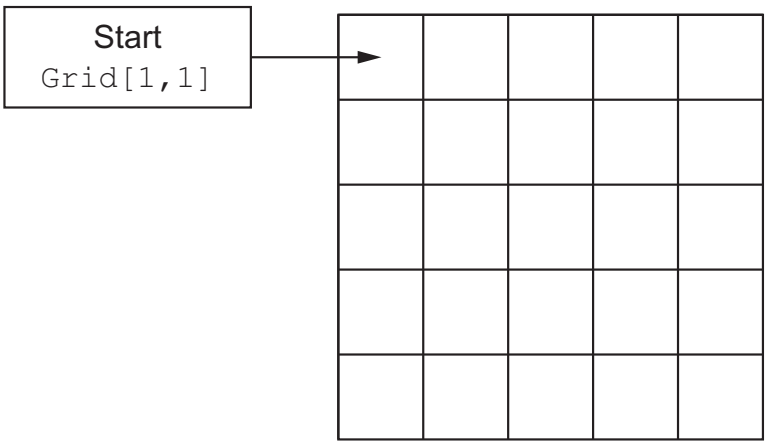
[15]

11 A one-player game uses the two-dimensional (2D) array `Grid[]` to store the location of a secret cell to be found by the player in 10 moves. Each row and column has 5 cells.



At the start of the game:

- The program places an 'X' in a random cell (**not** in `Grid[1,1]`) and empties all the other cells in the grid.
- The player starts at the top left of the grid.
- The player has 10 moves.

During the game:

- The player can move left, right, up or down by one cell and the move must be within the grid.
- "You Win" is displayed if the player moves to the cell with 'X' and has played 10 moves or less.
- "You Lose" is displayed if the player has made 10 moves without finding the 'X'.

Write a program that meets these requirements.

You must use pseudocode or program code **and** add comments to explain how your code works.

You do **not** need to declare any arrays or variables; you may assume that this has already been done.

All inputs and outputs must contain suitable messages.

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IGCSE COMPUTER SCIENCE • EXERCISE SHEET

8.3 File handling

Name: _____ Class: _____ Date: _____ **Total: 9 marks**

KEY WORDS file 文件 • file handling 文件处理 • variable 变量 • array 数组 • constant 常量

Objective

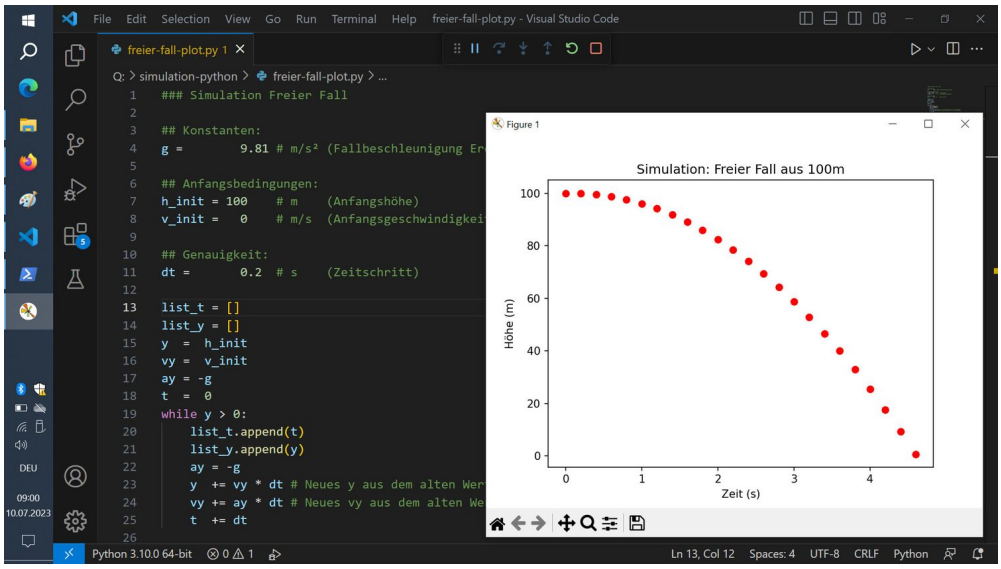
Build the skills to answer exam questions on **file handling** 文件处理 — storing data in a **file** 文件 so it is kept after the program stops, and the **open → use → close** pattern for reading and writing.

You must be able to:

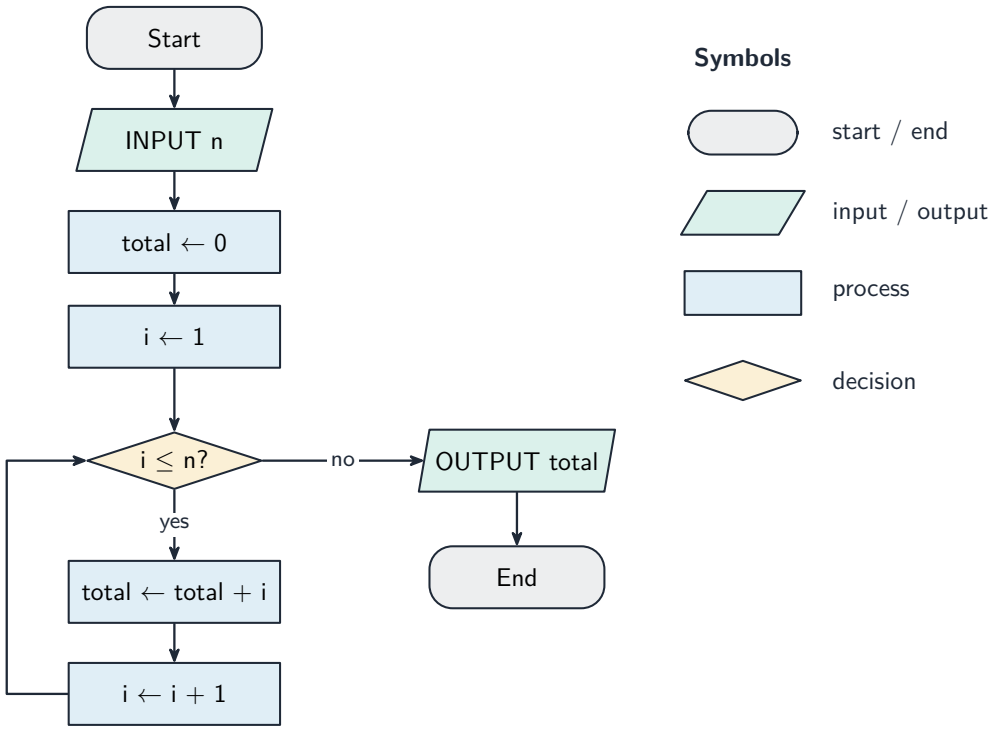
- explain why a program uses a file to store data
- write pseudocode to **open, write, read and close** a file
- describe the difference between writing to and reading from a file

1 Worked examples

Open, use, close



Data written to a file is kept after the program stops, unlike a variable in memory



File handling follows an open - read/write - close sequence

Write then read back one line:

- `OPENFILE "data.txt" FOR WRITE` → `WRITEFILE "data.txt", "Hello"` → `CLOSEFILE "data.txt"`
- `OPENFILE "data.txt" FOR READ` → `READFILE "data.txt", line` → `CLOSEFILE "data.txt"`

Always **close** a file when finished.

2 Practice

2.1 State one reason a program stores data in a file rather than in a variable. [1]

2.2 State the three steps used to handle a file, in order. [3]

3 Exam-style questions

3.1 A program must keep its data after it stops running. The data should be stored: [1]

- **A** in a variable
- **B** in a constant
- **C** in a file
- **D** in an array

3.2 A program writes a player's name to a file, then later reads it back.

(a) Write pseudocode to open `scores.txt`, write the name in variable `playerName` to it, and close it. [3]

(b) State what could go wrong if the file is **not** closed after writing. [1]

Solutions

2.1 a file keeps the data after the program stops / it is permanent (non-volatile) storage.

2.2 open the file; read or write the data; close the file.

3.1 C. A file keeps data after the program stops.

3.2 (a) `OPENFILE "scores.txt" FOR WRITE`; `WRITEFILE "scores.txt", playerName`; `CLOSEFILE "scores.txt"`.
(b) the data may not be saved properly / the file may be left locked or corrupted.

9 A school stores all the students' attendance data in a file called `Attendance.txt`

Write an algorithm in pseudocode to read a line of text from the file and store this line in the variable `StudentAttendance`

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..... [4]

10 The variables `Seconds` and `Minutes` are used in a program. `Seconds` holds the number of seconds as a whole number and `Minutes` holds the number of minutes as a whole number.

(a) Write pseudocode statements to declare the variables `Seconds` and `Minutes`

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..... [1]

(b) The procedure `Time(TotalSeconds)` takes the number of seconds as a parameter. The procedure converts the value held in the parameter into minutes and seconds and outputs the result.

Write this procedure in pseudocode.

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..... [4]

2 Tick (✓) **one** box to complete this sentence.

The pseudocode to store a hotel name held in the variable `Name` to a text file is

A `READFILE Hotels.txt, Name` ☐

B `WRITEFILE Hotels.txt, Name` ☐

C `WRITEFILE Name, Hotels.txt` ☐

D `STOREFILE Hotels.txt, Name` ☐

[1]