MODULE M PROGRAMMING · M19

Two-dimensional arrays and looping through them

Original practice questions · 21 marks · ~25 minutes · Cambridge 0478 syllabus 8.2.1, 8.2.2, 8.2.3, 7.7, 7.8, 7.9

Name _____ Date _____

Instructions. Answer all questions in the spaces provided. The marks for each part are shown in brackets [ ]. The total for this worksheet is **21 marks**. Write all algorithms and statements in pseudocode. All data on this sheet is made up.

1

Total: 4 marks

A water company records the total rainfall, in millimetres to one decimal place, for each of the 12 months of a year at each of its 5 reservoirs. The data is to be stored in a 2D array called `Rainfall`. The first index is the month (1 to 12) and the second index is the reservoir (1 to 5).

(a) Write a pseudocode statement to declare the array `Rainfall`. Use a lower bound of 1 for both indexes. **[2]**

(b) State **two** benefits of storing this data in one 2D array instead of in 60 separate variables. **[2]**

1

2

2

Total: 3 marks

A bank of parcel lockers has 4 rows of 5 lockers. The 2D array `Lockers` is declared as:

```
DECLARE Lockers : ARRAY[1:4, 1:5] OF CHAR
```

The first index is the row and the second index is the column. Each element stores `'E'` if the locker is empty or `'F'` if it is full. The array currently holds:

	Column 1	Column 2	Column 3	Column 4	Column 5
Row 1	'E'	'F'	'F'	'E'	'F'
Row 2	'F'	'F'	'F'	'F'	'F'
Row 3	'E'	'E'	'F'	'E'	'E'
Row 4	'F'	'E'	'F'	'F'	'F'

(a) State the value stored in `Lockers[4, 2]` **[1]**

(b) A parcel is placed in the locker in row 1, column 4. Write a pseudocode statement to record this in the array. **[1]**

(c) Explain why the statement `OUTPUT Lockers[5, 2]` would cause an error. **[1]**

3

Total: 5 marks

This algorithm uses the array `Lockers` from **Question 2**, holding the values shown in the table.

```
01 FOR Row ← 1 TO 4
02     Count ← 0
03     FOR Column ← 1 TO 5
04         IF Lockers[Row, Column] = 'E'
05           THEN
06             Count ← Count + 1
07         ENDIF
08     NEXT Column
09     OUTPUT "Row ", Row, ": ", Count, " empty"
10 NEXT Row
```

(a) Write down the output from the algorithm. **[4]**

(b) Explain why line 02 is placed **inside** the outer loop and not before line 01. **[1]**

4 **Total: 3 marks**

A company has 4 coffee kiosks. The number of drinks sold by each kiosk on each of 7 days is stored in the 2D array `Sales[1:4, 1:7]`. The first index is the kiosk (1 to 4) and the second index is the day (1 to 7).

This algorithm should output the total number of drinks sold by all 4 kiosks on each day. It contains **three** errors.

```
01 FOR Day ← 1 TO 4
02     DayTotal ← 0
03     FOR Kiosk ← 1 TO 4
04         DayTotal ← DayTotal + Sales[Day, Kiosk]
05     NEXT Day
06     OUTPUT "Day ", Day, " total: ", DayTotal
07 NEXT Day
```

(a) Identify the line number of each error and write the corrected pseudocode for that line. **[3]**

Error 1 Line number ..... Correction

Error 2 Line number ..... Correction

Error 3 Line number ..... Correction

5 **Total: 6 marks**

A fish farm has 6 tanks. The pH of the water in each tank is tested 8 times a day. One day's results have already been stored in the 2D array `TankPH[1:6, 1:8]` of type REAL. The first index is the tank number (1 to 6) and the second index is the test number (1 to 8).

(a) Write an algorithm, using pseudocode, to: **[6]**

- input a tank number, and keep asking for it until a number from 1 to 6 inclusive is entered
- calculate the average pH of that tank over its 8 tests
- output the average, rounded to one decimal place, with a suitable message
- output `Check water` once, after the average, if **any** of that tank's results is below 6.5

You do not need to declare any variables.

Total for this worksheet: 21 marks