Ch14

Programming and Data Representation

CHAPTER ASSIGNMENT · 27 MARKS

Name _____ Class _____ No. _____ Date _____

Answer every question in the space given. Show your working. You may use the chapter page to help you.

Questions from *Computer Science for Cambridge International AS & A Level Coursebook*, 2nd edition, Sylvia Langfield and Dave Duddell (Cambridge University Press), for classroom use.

Tasks and questions from the chapter

Q14.01 **Question 14.01:** Evaluate each of the following expressions:

(a) `4 * 3 - 3 ^ 2`

(b) `(4 * 3 - 3) ^ 2`

(c) `4 * (3 - 3) ^ 2`

(d) `4 * (3 - 3 ^ 2)`

T14.01 **Task 14.01:** Use the IDE of your chosen programming language (in future just referred to as 'your language'). Type the program statements equivalent to the following pseudocode (you may need to declare the variable `YourName` first):

```
INPUT "What is your name? " YourName
OUTPUT "Have a nice day ", YourName
```

Save your program as Example1 and then run it. Is the output as you expected?

T14.02 **Task 14.02:**

(a) Look at the identifier tables in Chapter 12 (Tables 12.02 and 12.04 to 12.12). Decide which data type from your language is appropriate for each variable listed.

(b) Write program code to implement the pseudocode from Worked Example 12.01 in Chapter 12.

T14.03 **Task 14.03:** Write program code to implement the pseudocode from Worked Example 12.03 in Chapter 12.

T14.04 **Task 14.04:** Write program code to implement the pseudocode from Worked Example 12.02 in Chapter 12.

T14.05 **Task 14.05:** The problem to be solved: the user enters the number of the month and year. The output is the number of days in that month. The program has to check if the year is a leap year for February.

The pseudocode solution is:

```
INPUT MonthNumber
INPUT Year
Days <- 0
CASE OF MonthNumber
  CASE 1,3,5,7,8,10,12 : Days <- 31
  CASE 4,6,9,11 : Days <- 30
  CASE 2 : Days <- 28
    If Year MOD 400 = 0
      THEN // it is a leap year
        Days <- 29
    ENDIF
    IF (Year MOD 4 = 0) AND (Year MOD 100 > 0)
      THEN // it is a leap year
        Days <- 29
    ENDIF
  OTHERWISE OUTPUT "Invalid month number"
ENDCASE
OUTPUT Days
```

Write program code to implement the pseudocode above.

T14.06 **Task 14.06:**

(a) Write program code to implement the pseudocode from Worked Example 12.05 in Chapter 12.

(b) Write program code to implement the pseudocode from Worked Example 12.08 in Chapter 12.

(c) Write program code to implement the pseudocode from Worked Example 12.09 in Chapter 12.

T14.07 **Task 14.07:**

(a) Write program code to implement the pseudocode from Worked Example 12.04 in Chapter 12.

(b) Write program code to implement the first algorithm from Worked Example 12.06 in Chapter 12.

T14.08 **Task 14.08:** Write program code to implement the second algorithm from Worked Example 12.06 in Chapter 12.

DP **Discussion Point:** Investigate your own programming environment and research other library routines.

T14.09 **Task 14.09:**

(a) Write program code to generate 20 random numbers in the range 1 to 10 inclusive.

(b) Write program code to implement the pseudocode using a pre-condition loop from Worked Example 12.07 in Chapter 12.

DP **Discussion Point:** What other useful functions can you find? Which module libraries have you searched?

T14.10 **Task 14.10:** Write program code to implement the pseudocode from Worked Example 12.11 in Chapter 12.

T14.11 **Task 14.11:** Write program code to implement the pseudocode from Worked Example 13.05 in Chapter 13. Which variables are global and which are local?

T14.12 **Task 14.12:** Write a function to implement the following pseudocode:

```
FUNCTION Factorial (Number : INTEGER) RETURNS INTEGER
    DECLARE Product : INTEGER
    Product <- 1
    FOR n <- 2 TO Number
        Product <- Product * n
    NEXT n
    RETURN Product
ENDFUNCTION
```

DP **Discussion Point:** Can you see how the two procedures `OutputSpaces` and `OutputSymbols` have been replaced by a single procedure `OutputChars` without changing the effect of the program?

T14.13 **Task 14.13:**

(a) Write program code to implement the pseudocode from Worked Example 13.01 in Chapter 13.

(b) Write program code to implement the pseudocode from Worked Example 13.02 in Chapter 13.

(c) Write program code to implement the improved algorithm from Worked Example 13.03 in Chapter 13.

T14.14 **Task 14.14:**

(a) Write program code to implement the pseudocode from Worked Example 13.04 in Chapter 13; first initialise the table and then output its contents.

(b) Write program code to implement the pseudocode from Worked Example 13.05 in Chapter 13.

T14.15 **Task 14.15:** Fred surveys the students at his college to find out their favourite hobby. He wants to present the data as a tally chart. Fred plans to enter the data into the computer as he surveys the students. After data entry is complete, he wants to output the total for each hobby.

#	Hobby	Tally
1	Reading books	`\\\`
2	Play computer games	`\\\\\\\\`
3	Sport	`\\\\\`
4	Programming	`\\`
5	Watching TV	`\\\\\\\\\\`

He starts by writing an algorithm:

```
Initialise Tally array
REPEAT
    INPUT Choice // 1 for Reading, 2 for computer games,
                 // 3 for Sport, 4 for Programming, 5 for TV
                 // 0 to end input
    Increment Tally[Choice]
UNTIL Choice = 0
FOR Index = 1 TO 5
    OUTPUT Tally[Index]
NEXT Index
```

(a) Write program code to declare and initialise the array `Tally : ARRAY[1:5] OF INTEGER`.

(b) Write program code to implement the algorithm above.

(c) Write program code to declare an array to store the hobby titles and rewrite the `FOR` loop of your program in part 2 so that the hobby title is output before each tally.

(d) Write program code to save the array data in a text file.

(e) Write program code to read the data from the text file back into the initialised array.

RP **Reflection Point:** How much practice have you had writing programs? Did you get them to work? How difficult did you find the different constructs? Put the following in order of difficulty:

- Using a FOR loop
- Using a WHILE loop
- Using an IF ELSE statement
- Declaring a variable of a standard data type
- Declaring and using a constant
- Using a 1D array
- Using a nested loop to access each element in a 2D array
- Reading from and writing to a text file
- Using a built-in function
- Writing a procedure and calling it from the main program
- Writing a function and using its return value in an expression in the main program
- Using parameters with procedures and functions

Exam-style questions

1 Preeti wants a program to output a conversion table for ounces to grams (1 ounce is 28.35 grams). She writes an algorithm using Structured English:

```
OUTPUT "Ounces Grams"
FOR Ounces FROM 1 TO 30
    SET Grams TO Rounded(Ounces * 28.35) // whole number of grams only
    OUTPUT Ounces and Grams
```

Write pseudocode to implement the algorithm. Include formatting, so that the output is tabulated. [7]

2 Write pseudocode to accept an input string `UserID`. The pseudocode is to test the `UserID` format. A valid format `UserID` consists of three upper case letters and four digits. The program is to output a message whether `UserID` is valid or not. [5]

3 Write pseudocode for a procedure `OutputTimesTable` that takes one integer parameter, `n`, and outputs the times table for `n`. For example the procedure call `OutputTimesTable(5)` should produce:

```
1 x 5 = 5
2 x 5 = 10
3 x 5 = 15
4 x 5 = 20
5 x 5 = 25
6 x 5 = 30
7 x 5 = 35
8 x 5 = 40
9 x 5 = 45
10 x 5 = 50
```

[6]

4 Write pseudocode for a function `isDivisible()` that takes two integer parameters, `x` and `y`. The function is to return the value True or False to indicate whether `x` is exactly divisible by `y`. For example, `isDivisible(24, 6)` should return True and `isDivisible(24, 7)` should return False. [6]

5 A poultry farm packs eggs into egg boxes. Each box takes six eggs. Boxes must not contain fewer than six eggs. Write pseudocode for a procedure `EggsIntoBoxes` that takes an integer parameter, `NumberOfEggs`. The procedure is to calculate how many egg boxes can be filled with the given number of eggs and how many eggs will be left over. The procedure is to return two values as parameters, `NumberOfBoxes` and `EggsLeftOver`. [9]

6 In a certain country, car registrations consist 7 alphanumerical characters. The format of a car registration is either `LLNNLLL` or `LLLNNLL` where L is any capital letter and N is any numeral 0 to 9. Use pseudocode to write a function that takes a string as parameter and returns TRUE if the format is valid and FALSE otherwise. The string-handling functions available are those listed in Table 14.06. [7]

End of assignment · Check your answers against the chapter at gurujazzy.com/subjects/computer-science/as-a-level/programming-data-representation/