Ch12

Algorithm Design and Problem-solving

CHAPTER ASSIGNMENT · 15 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

12.01 Use the aerial photograph in Figure 12.01 and draw a map just showing the essential details for finding a route from landmark A to landmark B.



Figure 12.01 Aerial photograph of part of a city

12.02 Write the steps to be followed to:

- make a sandwich
- walk from your school/college to the nearest shop
- log on to your computer.

12.03 Consider the following algorithm steps.

1 Input a length in inches.

2 Calculate the equivalent in centimetres.

3 Output the result.

List the variables required in an identifier table.

Write pseudocode for the algorithm.

12.04 A town has a bus service where passengers under the age of 12 and over the age of 60 do not need to pay a fare. Write the logic statements for free fares.

Q12.01 What changes do you need to make to output the smallest number?

Q12.02 What changes do you need to make to the algorithm in Worked Example 12.04:

(a) to compare 100 numbers?

(b) to take as a first input the number of numbers to be compared?

12.05 Change the algorithm in Worked Example 12.08 so that the sequence of numbers is terminated by a rogue value of 0.

12.06 Use stepwise refinement to output a hollow triangle. For example the two input values A and 9 result in the following output:

```
    A
   A A
  A   A
 A     A
AAAAAAAAA
```

A first attempt at solving this problem using structured English is:

```
01  Set up initial values
02  REPEAT
03      Output leading number of spaces
04      Output symbol, middle spaces, symbol
05      Adjust number of spaces and number of symbols to be output in
        next row
06  UNTIL the required number of symbols have been output in one row
```

12.07 Amend your algorithm for Task 12.05 to use modules.

RP **Reflection Point:** Can you think of other problems and use decomposition to break them down into basic constructs, input and output statements?

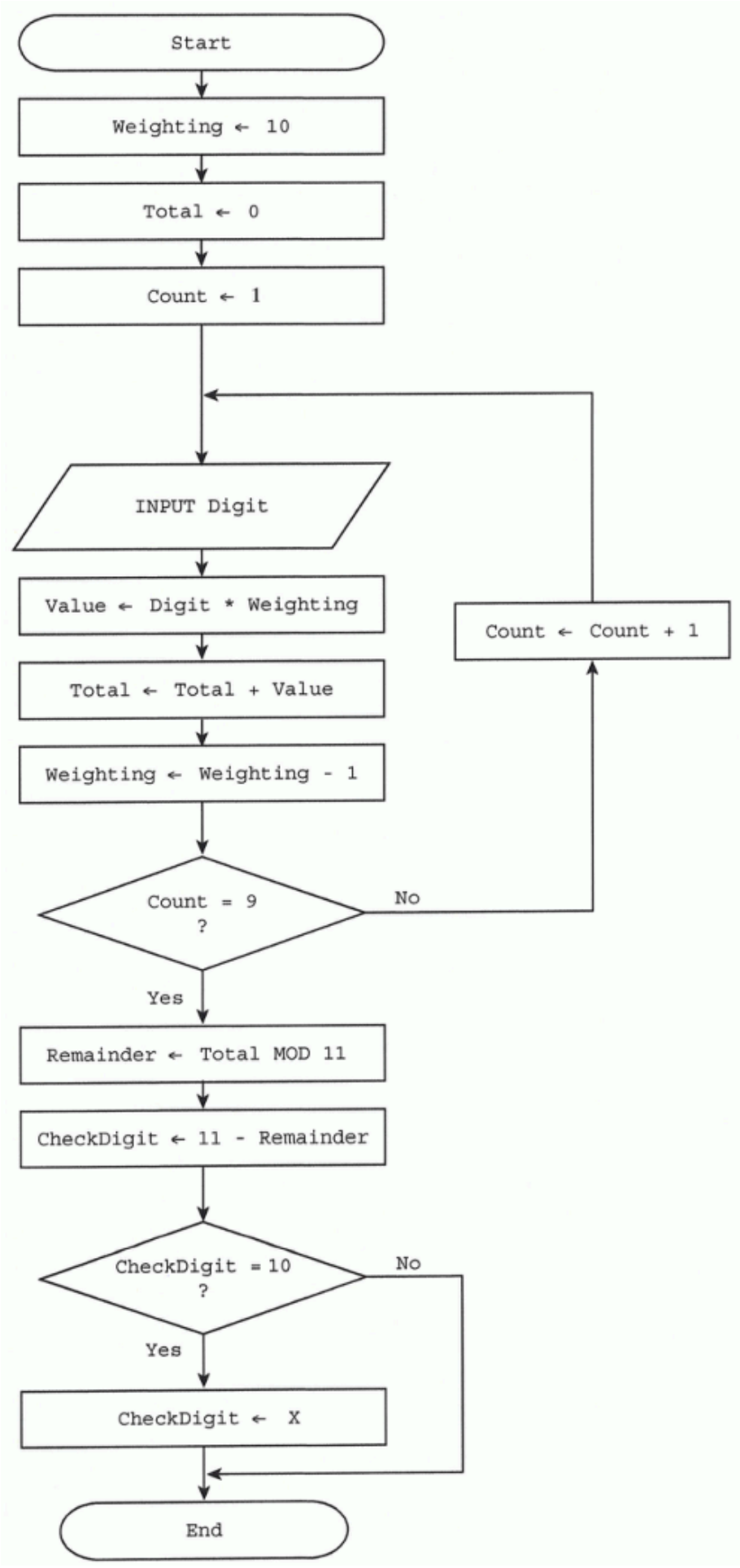
Exam-style questions

1. The Modulo-11 method of calculating a check digit for a sequence of nine digits is as follows:

   Each digit in the sequence is given a weight depending on its position in the sequence. The leftmost digit has a weight of 10. The next digit to the right has a weight of 9, the next one 8 and so on. Values are calculated by multiplying each digit by its weight. These values are added together and the sum is divided by 11. The remainder from this division is subtracted from 11 and this value is the check digit. If this value is 10, then the check digit is X. Note that `x MOD y` gives the remainder from the division of `x` by `y`.

   The flowchart shows the algorithm for calculating the Modulo-11 check digit.

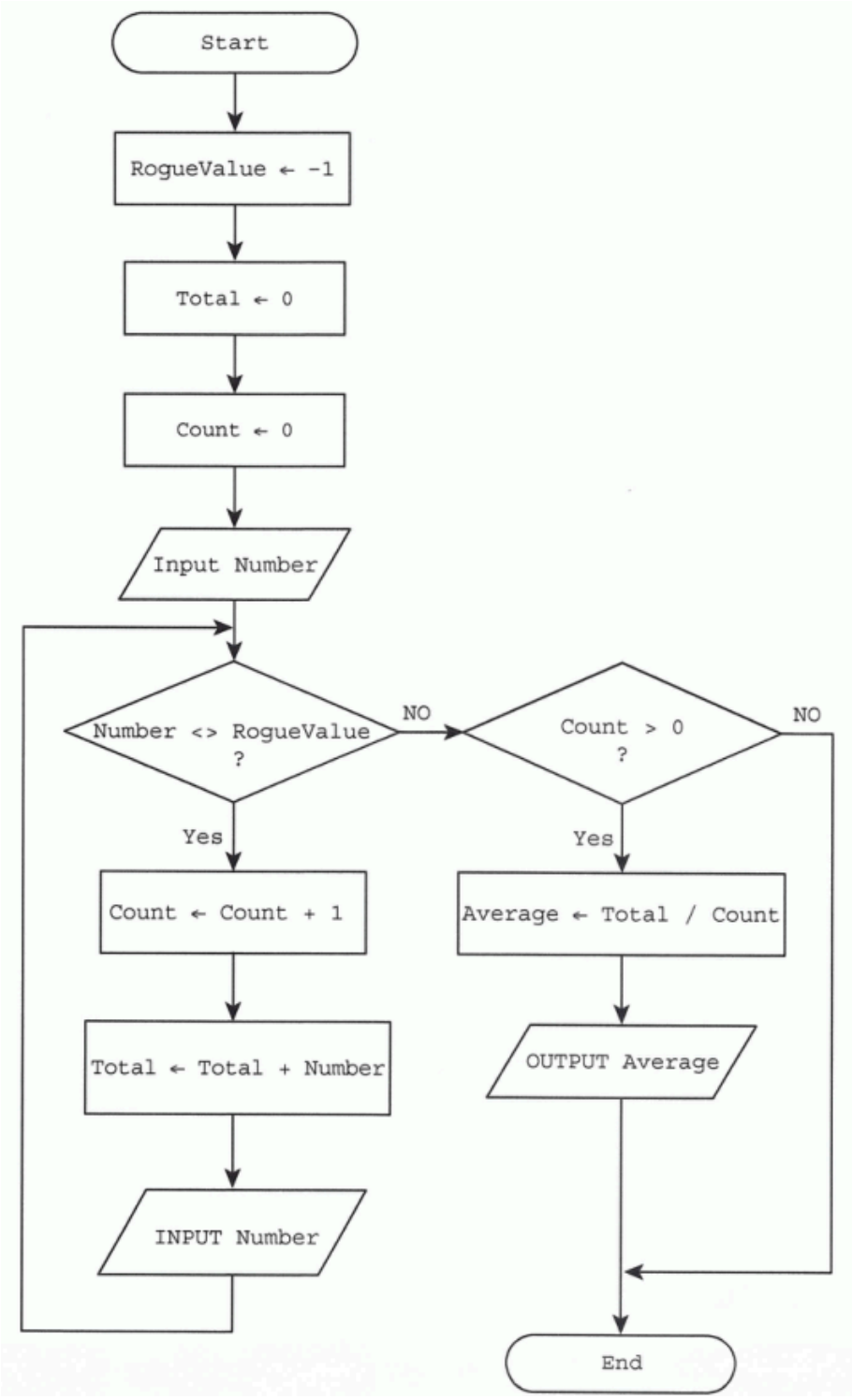
   Write pseudocode from the flowchart. [9]


Start
Weighting ← 10
Total ← 0
Count ← 1
INPUT Digit
Value ← Digit * Weighting
Total ← Total + Value
Weighting ← Weighting - 1
Count = 9 ?
No
Count ← Count + 1
Yes
Remainder ← Total MOD 11
CheckDigit ← 11 - Remainder
CheckDigit = 10 ?
No
Yes
CheckDigit ← X
End

2 Write pseudocode for the following problem given in structured English. [7]

```
REPEAT the following UNTIL the number input is zero
INPUT a number
Check whether number is positive or negative
Increment positive number count if the number is positive
Increment negative number count if the number is negative
```

3 Write pseudocode from the given flowchart. Use a `WHILE` loop. [8]



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