# Homework 3: Writing and interpreting algorithms

1. The numbers 15, 73, 29, 66, 35, 11, 43, 21 are to be sorted using a bubble sort.

The algorithm is given below.

REPEAT

FLAG = FALSE

FOR count = 1 to n-1

IF a[count] > a[count + 1] THEN

temp = a[count]

a[count] = a[count] + 1

a[count+1] = temp

flag = TRUE

ENDIF

ENDFOR

n = n-1

UNTIL n = 1 OR flag = FALSE

(a) Show the state of the array after each pass through the data. [3]

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **15** | **73** | **29** | **66** | **35** | **11** | **43** | **21** |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |

(b) What is the purpose of the variable **flag** in the algorithm? [1]

(c) How many times will the REPEAT loop be performed when sorting the following numbers? Explain your answer. [2]

32, 11, 15, 21, 29, 35, 43, 66, 73

(d) Name **two** circumstances in which a Bubble sort will execute in about the same time as a much more efficient sort algorithm such as the recursive Merge sort. [2]

2. A factory uses barcodes which represent 6 digits, with the last digit being a check digit.

For example, 253217 is a valid barcode.

The check digit is calculated as follows:

* assign weights of 1, 3, 1, 3, 1 to the five digits
* multiply each digit by its weight
* add the weighted numbers together
* divide the total by 10
* the remainder is the check digit

(a) One of the following barcodes is invalid. Which one is invalid, and what should the check digit be?

(i) 365125

(ii) 212557 [2]

(b) Write a pseudocode algorithm which

* inputs 100 barcodes, each input as six individual random digits
* recalculates the check digit for each one and compares it with the one input
* outputs the number of barcodes which were input correctly [5]

[Total 15 marks]