D1 Sorting And Bin Packing Exam Questions (Edexcel)

Q1.

42 21 15 16 35 10 31 11 27 39

(a) Use the first-fit bin packing algorithm to determine how the numbers listed above can be packed into bins of size 65

(3)

(b) The list of numbers is to be sorted into descending order. Use a quick sort to obtain the sorted list. You should show the result of each pass and identify your pivots clearly.

(4)

(c) Use the first-fit decreasing bin packing algorithm on your ordered list to pack the numbers into bins of size 65

(3)

The nine distinct numbers below are to be sorted into descending order

23 14 17 x 21 18 8 20 11

A bubble sort, starting at the left-hand end of the list, is to be used to obtain the sorted list. After the first complete pass, the list is

23 17 x 21 18 14 20 11 8

After the second complete pass, the list is

23 17 21 18 x 20 14 11 8

(d) Using this information, write down the smallest interval that must contain x. Give your answer as an inequality.

(3)

(Total for question = 13 marks)

(Q02 6689/01, June 2017)

Q2.

59 45 18 55 47 11 63 17 15 42

(a) The list of numbers above is to be sorted into descending order. Perform a quick sort to obtain the sorted list. You should show the result of each pass and identify your pivots clearly.

(4)

The numbers in the list represent the lengths, in cm, of some pieces of copper wire. The copper wire is sold in one metre lengths.

(b) Use the first-fit decreasing bin packing algorithm to determine how these pieces could be cut from one metre lengths. (You should ignore wastage due to cutting.)

(3)

(c) Determine whether your solution to (b) is optimal. Give a reason for your answer.

(2)

(Total for question = 9 marks)

(Q02 6689/01, June 2016)

Q3.

24 14 8 x 19 25 6 17 9

The numbers in the list represent the exact weights, in kilograms, of 9 suitcases. One suitcase is weighed inaccurately and the only information known about the unknown weight, x kg, of this suitcase is that $19 < x \leq 23$. The suitcases are to be transported in containers that can hold a maximum of 50 kilograms.

(a) Use the first-fit bin packing algorithm, on the list provided, to allocate the suitcases to containers.

(3)

(b) Using the list provided, carry out a quick sort to produce a list of the weights in **descending** order. Show the result of each pass and identify your pivots clearly.

(4)

(c) Apply the first-fit decreasing bin packing algorithm to the ordered list to determine the 2 possible allocations of suitcases to containers.

(4)

After the first-fit decreasing bin packing algorithm has been applied to the ordered list, one of the containers is full.

(d) Calculate the possible integer values of x. You must show your working.

(2)

(Total 13 marks)

(Q05 6689/01, June 2014)

Q4.

A carpet fitter needs the following lengths, in metres, of carpet.

20 33 19 24 31 22 27 18 25

He cuts them from rolls of length 50 m.

(a) Calculate a lower bound for the number of rolls he needs. You must make your method clear.

(2)

(b) Use the first-fit bin packing algorithm to determine how these lengths can be cut from rolls of length 50 m.

(3)

(c) Carry out a bubble sort to produce a list of the lengths needed in **descending** order. You need only give the state of the list after each pass.

(4)

(d) Apply the first-fit decreasing bin packing algorithm to show how these lengths may be cut from the rolls.

(3)

(Total 12 marks)

(Q01 6689/01, June 2012)

Q5.

5 1 8 13 16 5 8 2 15 12 10

(a) Use the first-fit bin packing algorithm to determine how the numbers listed above can be packed into bins of size 20.

(3)

(b) The list of numbers is to be sorted into **descending** order. Use a bubble sort to obtain the sorted list, giving the state of
the list after each **complete** pass.

(5)

(c) Apply the first-fit decreasing bin packing algorithm to your ordered list to pack the numbers into bins of size 20.

(3)

(d) Determine whether your answer to (c) uses the minimum number of bins. You must justify your answer.

(2)

(Total 13 marks)

(Q04 6689/01, Jan 2012)

Q6.

31 10 38 45 19 47 35 28 12

(a) Use the first-fit bin packing algorithm to determine how the numbers listed above can be packed into bins of size 60

(3)

(b) Carry out a quick sort to produce a list of the numbers in **descending** order. You should show the result of each pass and identify your pivots clearly.

(4)

(c) Use the first-fit decreasing bin packing algorithm to determine how the numbers listed can be packed into bins of size 60

(2)

(d) Determine whether the number of bins used in (c) is optimal. Give a reason for your answer.

(2)

(Total 11 marks)

(Q01 6689/01/R, June 2014)

Q7.

0.6
1.5
1.6
0.2
0.4
0.5
0.7
0.1
0.9
0.3

(a) Use the first-fit bin packing algorithm to determine how the numbers listed above can be packed into bins of size 2.

(3)

(b) The list of numbers is to be sorted into **descending order**. Use a quick sort to obtain the sorted list. You must make your pivots clear.

(4)

(c) Apply the first-fit decreasing bin packing algorithm to your ordered list to pack the numbers into bins of size 2.

(3)

(d) Determine whether your answer to (c) uses the minimum number of bins. You must justify your answer.

(1)

(Total 11 marks)

(Q01 6689/01, June 2013)

Q8.

29 52 73 87 74 47 38 61 41

The numbers in the list represent the lengths in minutes of nine radio programmes. They are to be recorded onto tapes which each store up to 100 minutes of programmes.

(a) Obtain a lower bound for the number of tapes needed to store the nine programmes.

(2)

(b) Use the first-fit bin packing algorithm to fit the programmes onto the tapes.

(3)

(c) Use the first-fit decreasing bin packing algorithm to fit the programmes onto the tapes.

(3)

(Total 8 marks)

(Q01 6689/01, June 2008)

Q9.

32	45	17	23	38	28	16	9	12	10

The numbers in the list above represent the lengths, in metres, of ten lengths of fabric. They are to be cut from rolls of fabric of length 60m.

(a) Calculate a lower bound for the number of rolls needed.

(2)

(b) Use the first-fit bin packing algorithm to determine how these ten lengths can be cut from rolls of length 60m.

(4)

(c) Use full bins to find an optimal solution that uses the minimum number of rolls.

(3)

(Total 9 marks)

(Q02 6689/01, June 2009)

Q10.

3.7	2.5	5.4	1.9	2.7	3.2	3.1	2.7	4.2	2.0

(a) Use the first-fit bin packing algorithm to determine how the numbers listed above can be packed into bins of size 8.5

(3)

The first-fit bin packing algorithm is to be used to pack n numbers into bins. The number of comparisons is used to measure the order of the first-fit bin packing algorithm.

(b) By considering the worst case, determine the order of the first-fit bin packing algorithm in terms of n. You must make your method and working clear.

(3)

(Total for question = 6 marks)

(Q01 8FM0/27, Oct 2020)

Q11.

4	6.5	7	1.3	2	5	1.5	6	4.5	6	1

The list of eleven numbers shown above is to be sorted into **descending** order.

(a) Carry out a **quick sort** to produce the sorted list. You should show the result of each pass and identify the pivots clearly.

(3)

(b) Use the **first-fit decreasing** bin packing algorithm to pack the numbers into bins of size 10

(3)

(c) Determine whether your answer to part (b) uses the minimum number of bins. You must justify your answer.

(2)

A **different** list of eleven numbers is to be sorted into **descending** order using a **bubble sort**. The list after the **second** pass is

4.5	5.6	3.8	6.7	5.4	1.6	4.8	9.1	3.3	1.7	1.5

(d) Explain how you know that at least one of the first two passes of the bubble sort was **not** carried out correctly.

(1)

(Total for question = 9 marks)

(Q01 8FM0/27, June 2024)