

QQQ – Decision 1 – Chapter 1 – Algorithms (Version 2)

Total Marks: 22

(22 = Platinum, 20 = Gold, 18 = Silver, 15 = Bronze)

1.

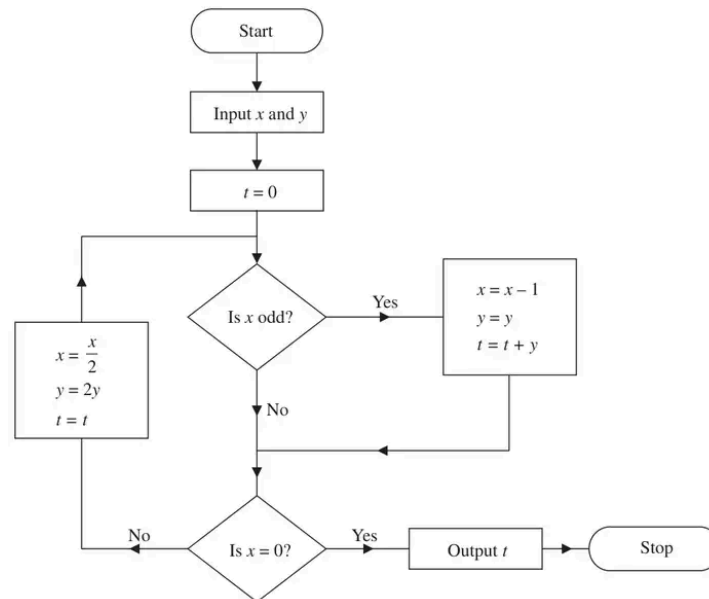


Figure 4

An algorithm is described by the flow chart shown in Figure 4.

Given that $x = 27$ and $y = 5$,

- (a) complete the table in the answer book to show the results obtained at each step when the algorithm is applied. Give the final output. (4)

The numbers 122 and $\frac{1}{2}$ are to be used as inputs for the algorithm described by the flow chart.

- (b) (i) State, giving a reason, which number should be input as x .
(ii) State the output. (3)

(Total 7 marks)

2. The nine distinct numbers in the following list are to be packed into bins of size 50

23	17	19	x	24	8	18	10	21
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When the first-fit bin packing algorithm is applied to the numbers in the list it results in the following allocation.

Bin 1: 23 17 8

Bin 2: 19 x 10

Bin 3: 24 18

Bin 4: 21

(a) Explain why $13 < x < 21$ (3)

The same list of numbers is to be sorted into descending order. 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	19	17	24	x	18	10	21	8
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(b) Using this information, write down the smallest interval that must contain x , giving your answer as an inequality. (2)

When the first-fit decreasing bin packing algorithm is applied to the nine distinct numbers it results in the following allocation.

Bin 1: 24 23

Bin 2: 21 19 10

Bin 3: 18 17 x

Bin 4: 8

Given that only one of the bins is full and that x is an integer,

(c) calculate the value of x . You must give reasons for your answer. (2)

(Total 7 marks)

3.

2.1	1.7	3.0	1.9	3.2	1.2	3.3	1.4	1.5	0.2
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- (a) Use the first-fit bin packing algorithm to determine how the numbers listed above can be packed into bins of size 5 (2)

The list of numbers is now to be sorted into descending order.

- (b) Perform a quick sort on the original list to obtain the sorted list. You should show the result of each pass and identify your pivots clearly. (4)

For a list of n numbers, the quick sort algorithm has, on average, order $n \log n$.

Given that it takes 2.32 seconds to run the algorithm when $n = 450$

- (c) calculate approximately how long it will take, to the nearest tenth of a second, to run the algorithm when $n = 11\,250$. You should make your method and working clear. (2)

(Total 8 marks)