

Algorithms – Q2 (20/11/23)

Use the Quick Sort algorithm to sort the following items into increasing order.

7 45 13 27 6 19 44 15 21

Solution

Step 1: Select the middle item (or the right-hand of the two middle items) as the pivot [in brackets here, but circled when handwritten]

7 45 13 27 (6) 19 44 15 21

Step 2: Pivot about 6: the remaining items (ie on either side of the 6) that are less than (or equal to) 6 go to the left of (6), without changing their order; similarly, items that are greater than 6 go to the right. The pivot is underlined, to indicate that its position in the list is fixed. Also, the next pivot(s) are labelled.

6 7 45 13 27 (19) 44 15 21 [2 marks]

Step 3: The process is repeated until all items are fixed:

6 7 (13) 15 19 45 27 (44) 21

[Here there are two 'sub-lists': 7 13 15 and 45 27 44 21; both of which produce a pivot.]

6 (7) 13 (15) 19 27 (21) 44 (45)

[Strictly speaking, 7, 15 and 45 are pivots, even though they are in sub-lists of 1 item each.]

6 7 13 15 19 21 (27) 44 45

6 7 13 15 19 21 27 44 45 [2 marks]

Note: Sometimes the first item is chosen as the pivot. Also the method of labelling the pivot varies. It is recommended to describe what is being done, and to define any labelling (so that it is clear that the pivoting process occurs in the line after the pivot has been identified).