Q. calculate manually number of instructions executed in insertion sort for following inputs:-

4 5 7 6

5 7 6 4

Ans:-

Steps involved / Number of instructions executed in insertion sort for,-

① 4 5 7 6

~~Step 1:~~

" we always assume the first array to be sorted, already. And we take the 2nd element as a 'key', to compare it with other elements."

Step 1: 4, 5, 7 6

↳ key

consider 2nd element (5) as 'key' And, compare it with the 1st element.

If 1st element is greater than key, then key becomes the 1st element.

⟹ "Key" is not ~~greater~~ smaller than the 1st element.

Step 2:- 4 5, 7, 6

↳ key.

consider next element (7) as key,

and compare it with the element
on its left (5).

⇒ (5) is smaller than (7) so, the
elements will remain in same order
and "key" will move to the
next element.

Step 3:- 4 5 7 6
                    └→key

consider (6) as key, and compare
it with the element on its
left (i.e, 7)

⇒ key (6) is smaller than the eleme-
nt on its left (i.e, 7). So 'Key"(6)
is placed at the place of "7",
which implies to,—

4 5 6 7

Hence, given input is sorted.

Total number of steps involved = 3.

(11)   5 7 6 4.

Step 1:-

consider the 2nd element(7) as "key". compare it with the element on its left (ie, 5). If "the key (7)" is smaller than element on its left (i.e, 5) then "key (7)" will be stored at the place of (5) left element.

If "key(7)" is greater than element on its left (5) they key will move to next element. (If no other element present on left of the just compared element) (ie, 5).

5 7 6 4
      ↳key

Compare
if key > 5
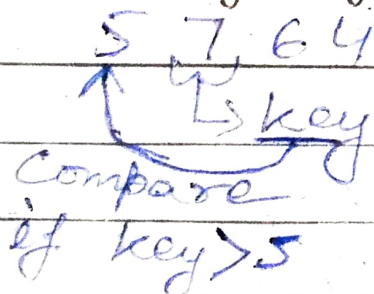
Step 2:-

5 7 6 4
      ↳ key

if key < 7 ~~True false~~

⟹ 5 6 7 4   TRUE

then

Step 3:-   5 6 7 4
                      → key

(if key > 7) ⟶ false.

#	5 6 4

5 6 7 4
             → key

(if key < 7) → True

(if key < 6) ⟶ True.

(if key < 5) → True
                    ↓ then
                  Stop.

| 4 5 6 7 | → Sorted array.

Total ~~elements~~ steps involved = 3.

Instructions :-

①   for $j = 2$ to Array length

②   key $= A[j]$

③ $i = j-1$

④   while $i > 0$ and $A[i] > key$

⑤ $A[i+1] = A[i]$

⑥ $i = i-1$

⑦ $A[i+1] = key.$

for 4 5 7 6 :-

Instructions	frequency
①	4
②	3
③	3
④	4
⑤	1
⑥	1
⑦	3

19 times.

⟹ 19 times above instructions will execute

for 5 7 6 4 -

Instructions	frequency
(I)	4
(II)	3
(III)	3
(IV)	7
(V)	4
(VI)	4
(VII)	3
	28

⇒ 28 times above instructions will execute