2(a) [redacted]

Partition procedure :

```
Partition (A, p, r)
  {
     x ← A[r];
     i ← p-1;
     for (j ← p to r-1)
      {
          if (A[j] ≤ x)
            {
               i ← i+1;
               A[i] ↔ A[j];
            }
      }
     i ← i+1;
     A[i] ↔ A[r] ; // Swapping
     return i
  }
```

Given A[9] = {2, 5, 7, 9, 6, 3, 1, 8, 4}

partition (A, 1, 9)

① Index → 1 2 3 4 5 6 7 8 9

| 2 | 5 | 7 | 9 | 6 | 3 | 1 | 8 | 4 |

x (pivot) = A[9]

x = 4, i = 0

j = 1

∵ A[j] ≤ 4

∴ i = i + 1

After Swapping

②

1	2	3	4	5	6	7	8	9
2	5	7	9	6	3	1	8	4

i = 1, j = 2

∵ A[j] > x, No operation

③

1	2	3	4	5	6	7	8	9
2	5	7	9	6	3	1	8	4

i = 1,

j = 3

∵ A[j] > x. No operation

(4)

1	2	3	4	5	6	7	8	9
2	5	7	9	6	3	1	8	4

$i = 1$
$j = 4$

$\because A[j] > x$, No operation

(5)

1	2	3	4	5	6	7	8	9
2	5	7	9	6	3	1	8	4

$i = 1$,
$j = 5$

$\because A[j] > x$, No operation

(6)

1	2	3	4	5	6	7	8	9
2	5	7	9	6	3	1	8	4

$i = 1$,
$j = 6$

$\because A[j] \leq x$,

$\therefore$ swapping & $i = i + 1 \Rightarrow i = 2$.

(7) After swapping

1	2	3	4	5	6	7	8	9
2	3	7	9	6	5	1	8	4

$i = 2$,
$j = 7$

$\because A[j] \leq x$

$\therefore$ $i = i + 1$; $i = 3$ & swapping

(8) After swapping

1	2	3	4	5	6	7	8	9	
2	3	1	9	6	5	7	8	4	i = 3
									j = 8

∵ A[j] > x, No operation

(9) loops end.

Now, i = i+1 ; i = 4 and swapping

∴ Resultant sequence After Swapping

2	3	1	(9)	6	5	7	8	4	i = 4
									x = 9

Ans :- ∴

2	3	1	4	6	5	7	8	9

↳ Resultant

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(b) Quick Sort(A, P, r){

if (P < r)

{ q → Partition (A, P, r); → n times

Quick Sort (A, P, q-1);

Quick Sort (A, q+1, r);

}

}

No. of elements : r - P + 1

⇒ n - 1 + 1

⇒ n

At for n elements we take T(n)

→ So, for above no. of elements

⇒ q - 1 - P + 1

→ q - P

∴ for q - 1 elements ⇒ T(q - 1)

→ for above no. of elements ⇒

⇒ r - q - 1 + 1

⇒ r - q

∴ for n - q elements ⇒ T(n - q)

$\therefore T(n) = T(q-1) + T(n-q) + n$

↳ General Recurrence Relation

* If A contains distinct elements and sorted in decreasing order the recurrence equation and its time complexity is ←

let $a[5] = \{ \overset{1}{8}, \overset{2}{7}, \overset{3}{5}, \overset{4}{3}, \overset{5}{1} \}$

↳ pivot

Correct pos^n of pivot element $\Rightarrow$

1	2	3	4	5
1	8	7	5	3

$n = 1$

$\therefore$ The position of pivot element is 1.

$\therefore$ putting $q = 1$ in General Rec-Relation

$\therefore T(n) = T(0) + T(n-1) + n$

$cn - cn$

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$\Rightarrow T(n) = \cancel{T(0)}^{c} + T(n-1) + n$

$\Rightarrow T(n) = T(n-1) + n$

recurrence equation

and its Time complexity is $O(n^2)$.