Branch : CSE & IT **Batch : Hinglish**

Algorithms

Divide and Conquer

DPP

[MCQ]

1. Consider an array containing the following elements in unsorted order (placed randomly) but 120 as first elements

120 160 30 190 14 24 70 180 110

Quick sort partitioning algorithm is applied by choosing first elements as pivot element. Then what is the total number of arrangements of array integers are possible preserving the effect of first pass of partitioning algorithm.

(a) 680 (b) 700

(c) 720 (d) 740

[MCQ]

2. Let $T(n) = [n(\log(n^3) - \log n) + \log n]n + \log n$.

complexity of T(n) is

(a) $O(n^2)$ (b) $O(n^3)$

(c) $O(n\log n)$ (d) $O(n^2\log n)$

[MCQ]

3. Assume that there are 4 sorted lists of $\frac{n}{4}$ elements each, if these lists are merged into a single sorted list of 'n' elements then how many key comparisons are required in the worst case using an efficient algorithm?

(a) $2n - 3$ (b) $\frac{7}{4}n - 3$

(c) $\frac{9}{4}n - 3$ (d) $\frac{6}{4}n - 3$

[NAT]

4. Consider the number in the sequence

2 5 11 17 19 21 26 33 39 40 51 65 79 88 99

Using binary search, the number of comparisons required to search elements '2' is____

[MCQ]

5. Merging 4 sorted files having 400, 100, 250, 50 records will take O (___) time?

(a) 800 (b) 400

(c) 200 (d) 100

Ans. (a)

Sol. Two sorted file of size m and n takes O(m + n) time for merging.

So, total time = 400 + 100 + 250 + 50 = 800

$\therefore$ (a) is correct.

[NAT]

6. Consider a machine which needs a minimum of 50 seconds to sort 500 names by quick sort, then what is the minimum time required to sort 50 names (approximately)is _____ (round off to 2 decimal)

[NAT]

7. What is the total number of comparisons that will be required in worst case to merge the following sorted files into a single sorted file into a single sorted file by merging together two files at a time____.

Files	F_1	F_2	F_3	F_4
Number of records	40	42	44	46

Answer Key

1. **(c)**
2. **(d)**
3. **(a)**
4. **(4 to 4)**
5. **(a)**
6. **(3.14 to 3.14)**
7. **(341 to 341)**

Hints & Solutions

1. (c)

We have to choose the I[st] elements as pivot. Here 120 is the I[st] element. After the I[st] pass I[st] elements goes to its exact location.

All the elements greater than 120 goes to right of 120 and lesser elements goes to left side of 120 after I[st] pass.

$$\underbrace{110 \quad 30 \quad 14 \quad 24 \quad 70}_{5!} \quad 120 \quad \underbrace{160 \quad 180 \quad 190}_{3!}$$

5! × 3!

⇒ 720 possible arrangement

∴ C is correct option.

2. (d)

Given

T(n) = [n (log(n^3) – logn) + logn] n + logn

$$= \left[n\left(\log\frac{n^3}{n}\right)+\log n\right]n+\log n$$

$$= \left[n\log n^2+\log n\right]n+\log n$$

$$= n^2\cdot 2\log n+n\log n+\log n$$

$$= 2n^2\log n+n\log n+\log n$$

= O(n^2logn)

∴ option (d) is correct.

3. (a)

$$\underbrace{\frac{n}{4} \quad \frac{n}{4}}_{\left\{\frac{n}{2}-1\right\}} \qquad\qquad \underbrace{\frac{n}{4} \quad \frac{n}{4}}_{\left\{\frac{n}{2}-1\right\}}$$

$$\underbrace{\text{Comparisons} \qquad \text{Comparisons}}_{n-1 \text{ Comparisons}}$$

Total number of comparisons = $\left(\frac{n}{2}-1\right)+\left(\frac{n}{2}-1\right)+(n-1)$

= 2n – 3

∴ option (a) is correct.

4. (4 to 4)

Low = 0, high = 15

$$\text{Mid} = \frac{0+15}{2} = 7$$

A[7] = 33

33 > 2

Low =0, high = 6;

$$\text{Mid} = \frac{0+6}{2} = 3$$

A[3] = 17

17 > 2

Low = 0, high = 2, mid = $\frac{0+2}{2} = 1$

A[1] = 5

5 > 2

Low = 0, high = 0, mid = $\frac{0+0}{2} = 0$

A[0] = 2

2 = = 2

5. (a)

Two sorted file of size m and n takes O(m + n) time for merging.

So, total time = 400 + 100 + 250 + 50 = 800

∴ (a) is correct.

6. (3.14 to 3.14)

In best case quick sort algorithm takes nlogn comparisons,

So, 500 × $\log_2$500 ≅ 4482.89

Which takes 50 seconds.

To sort 50 names a minimum of 50($\log_2$50) = 282.19 comparisons

∴ 282.19 comparisons are needed.

This takes = $50 \times \frac{282.19}{4482.89}$ = 3.14 second

7. (341 to 341)

Given files

40, 42, 44, 46} 82 – 1 = 81 comparisons

82, 44, 46} 90 – 1 = 89 comparisons

82, 90} 172 – 1 = 171 comparisons

So, 81 + 89 + 171 = 341 comparisons