CS & IT ENGINEERING

Algorithms

Design Stratagies
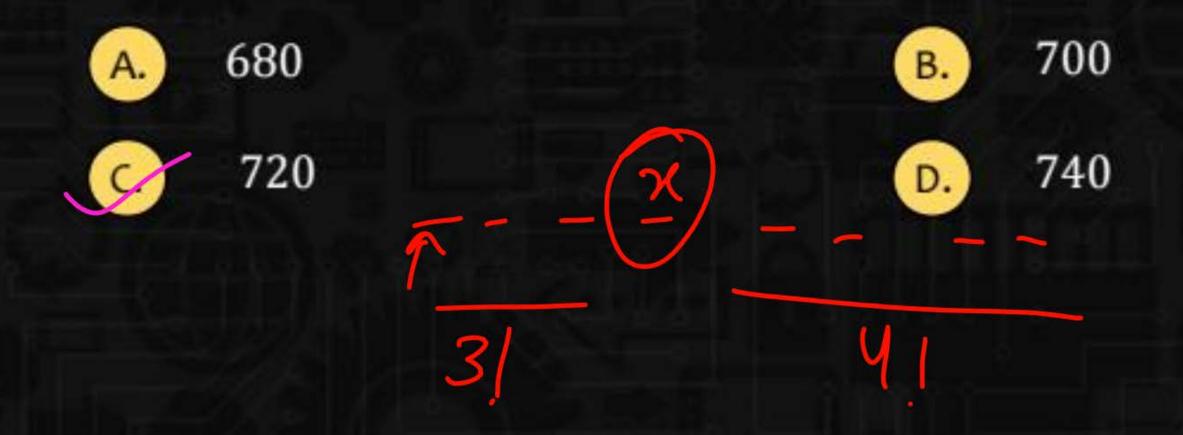
DPP

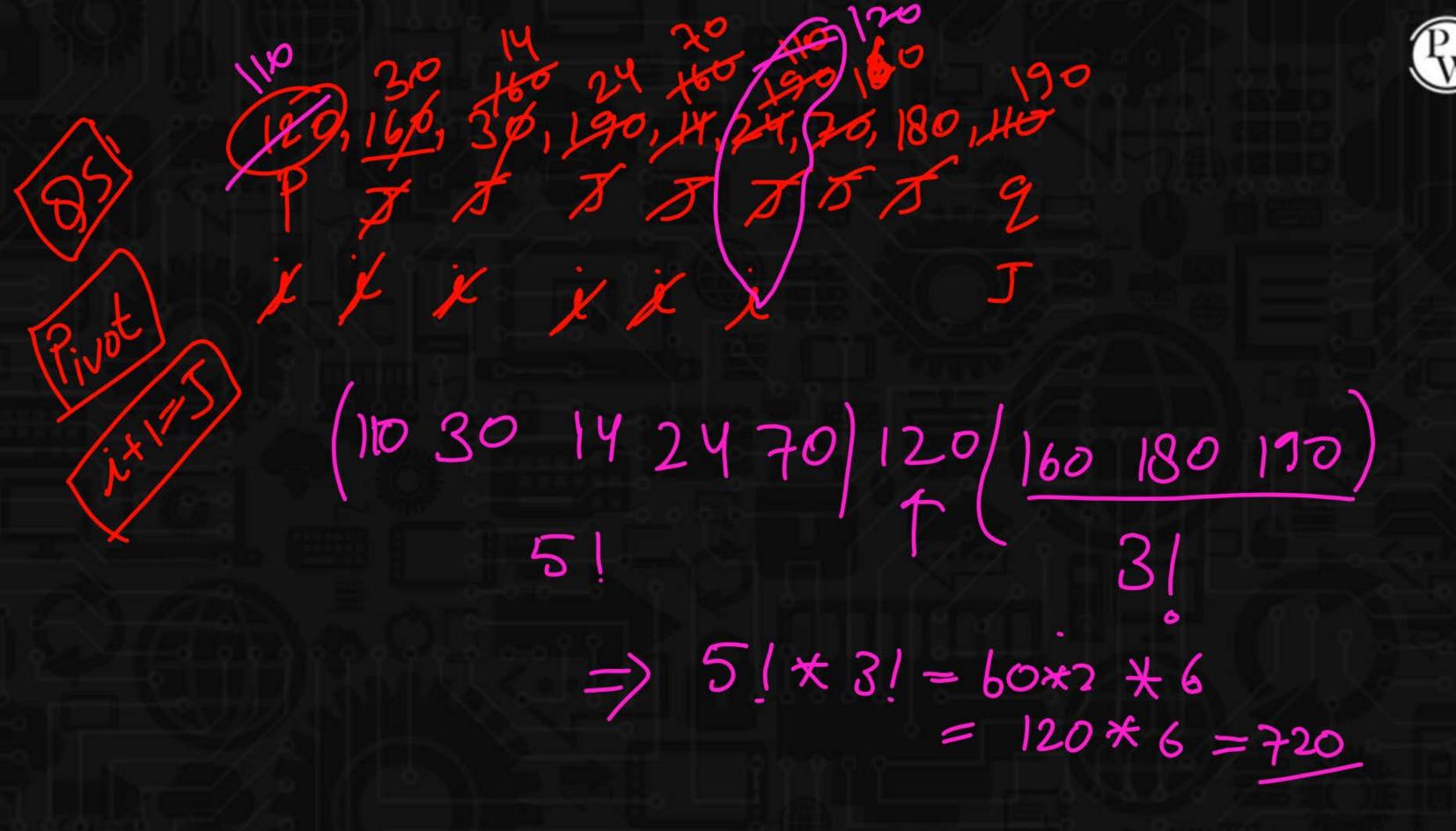(Discussion Notes)

By- Rohit Chauhan Sir

Q.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. **[MCQ]**
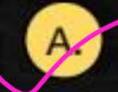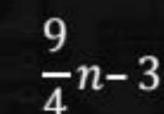
A. 680

B. 700

C. 720

D. 740

$$\frac{\quad}{3!} \quad (x) \quad \frac{\quad}{4!}$$

110

30
14
70 120

20

120

160

160

190

160

190

$\underset{p}{\cancel{110}}, \underset{i}{\cancel{160}}, \underset{i}{\cancel{30}}, \underset{i}{\cancel{190}}, \underset{i}{\cancel{14}}, \underset{i}{\cancel{24}}, \underset{j}{\cancel{70}}, 180, \cancel{110}$

180

190

q

J

$$\left(\underbrace{110 \quad 30 \quad 14 \quad 24 \quad 70}_{5!} \Big| \underset{\uparrow}{120} \Big| \underbrace{\overline{160 \quad 180 \quad 190}}_{3!} \right)$$

$$\Rightarrow 5! * 3! = 60*2 * 6$$
$$= 120 * 6 = 720$$

Q.2 Let $T(n) = [n(\log(n^3) - \log n) + \log n]n + \log n$, complexity of $T(n)$ is

[MCQ]

A. $O(n^2)$

B. $O(n^3)$

C. $O(n\log n)$

D. $O(n^2\log n)$

$$\left[n \left(\log n^3 - \log n \right) + \log r \right] n + \log n$$

$$\log \frac{m}{n} = \log m - \log n$$

$$\log m \cdot n = \log m + \log n$$

$$\boxed{\log m^K = K \log m}$$

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

$$\Rightarrow \left[n * \log \frac{n^3}{n} + \log n \right] n + \log n$$

$$\Rightarrow n^2 * \log n^2 + n \log n + \log n$$

$$\Rightarrow \textcircled{2} n^2 * \log n + n \log n + \log n = O(n^2 \log n)$$
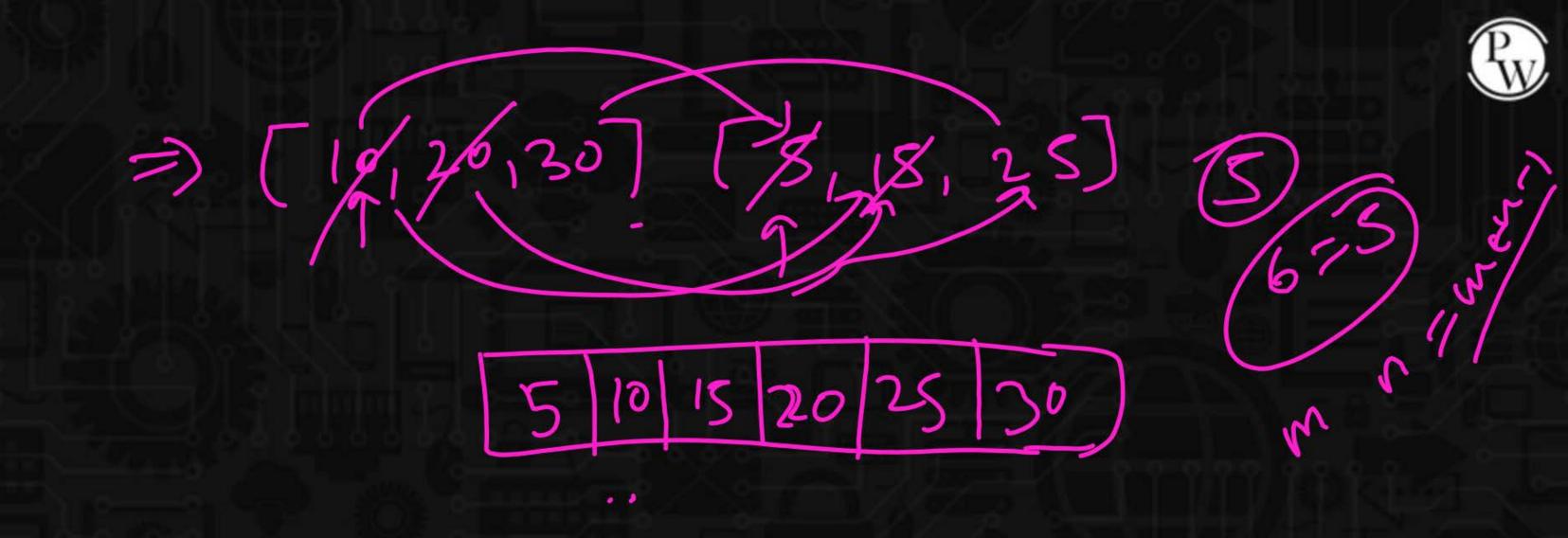
Q.3 Assume that there are 4 sorted lists of $\frac{n}{4}$ elements each, if these lists are merged into a single sorted list of 'n' elements then how many key comparisons are required in the worst case using an efficient algorithm?
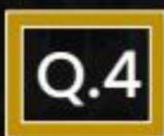
[MCQ]

A. $2n - 3$

B. $\frac{7}{4}n - 3$

C. $\frac{9}{4}n - 3$

D. $\frac{6}{4}n - 3$

$$\Rightarrow \quad [10, 20, 30] \quad [8, 18, 25]$$

5	10	15	20	25	30

$$\boxed{5}$$

$$6 = 5$$

$$m, n = mem$$

$$\Rightarrow \quad \frac{n}{4} \quad \frac{n}{4} \quad \frac{n}{4} \quad \frac{n}{4}$$

$$\Rightarrow \quad \frac{2n}{4} \quad \frac{2n}{4}$$

$$\frac{n}{2}-1$$

$$\boxed{n-1} \quad \Rightarrow$$

$$\underline{n}$$

$$\# \, Cm = \frac{n}{2}-1 + \frac{n}{2}-1$$
$$+ \, n-1$$

$$= \frac{n}{2}-1 + \frac{n}{2}-1 + n-1$$

$$= \underline{2n-3}$$

Q.4 Consider the number in the sequence

2, 5, 11 17 19 21 26 33 39 40 51 65 79 88 99
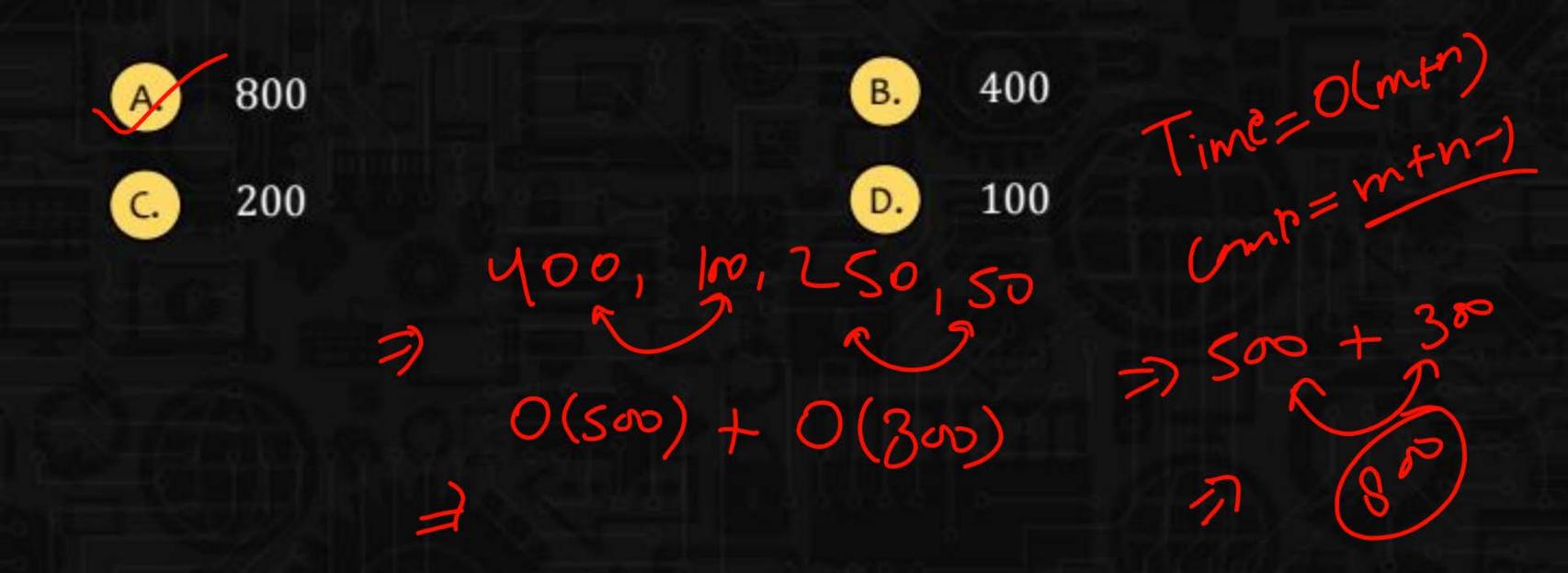
Using binary search, the number of comparisons required to search elements '2' is___

[NAT]

④

$$2, 5, 11, 17, 19, 21, 26, 33, 39, 40, 51, 65, 79, 88, 99$$
$$1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7 \quad 8 \quad 9 \quad 10 \quad 11 \quad 12 \quad 13 \quad 14 \quad 15$$

$mid = \dfrac{1+15}{2}$

$= \dfrac{16}{2}$

$= 8$

$mid = \dfrac{1+7}{2} = \dfrac{8}{2}$

$mid = \dfrac{1+3}{2} = \dfrac{4}{2} = 4 = 2$

$= \dfrac{1+1}{2} = 1$

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

[MCQ]

(A.) 800

B. 400

C. 200

D. 100

$$400, 100, 250, 50$$

$$\Rightarrow$$

$$O(500) + O(300)$$

$$\Rightarrow$$

$$Time = O(m+n)$$

$$Cmp = \underline{m+n-1}$$

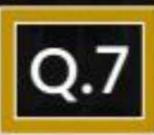$$\Rightarrow 500 + 300$$

$$\Rightarrow (800)$$

Q.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]**

3.14 3.15

500 names will take = 50 sec

$QS \quad TC = O(n \log n)$

$= 500 * \log 500 = 500 * 8.96 = 4482.89$

Unit

$50 sec = 4482.89$

for 50 namps

$$QS \quad TC = 50 \log 50$$

$$= \boxed{282.19}$$

$$= \frac{50}{4482.89} \times 282.19$$

$$= 3.147 = \underline{3.14 \text{ or } 3.15}$$

Q.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 ___.

[NAT]

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

two-way

$$Comp \Rightarrow 81 + 89$$
$$+ 171$$
$$= 260 + 81$$
$$\Rightarrow 341$$

82 90

172

THANK YOU GW SOLDIERS !