CS & IT ENGINEERING

Algorithms

Design Strategies (Divide & Conquer)

(Discussion Notes)

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01 Question

02 Discussion

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

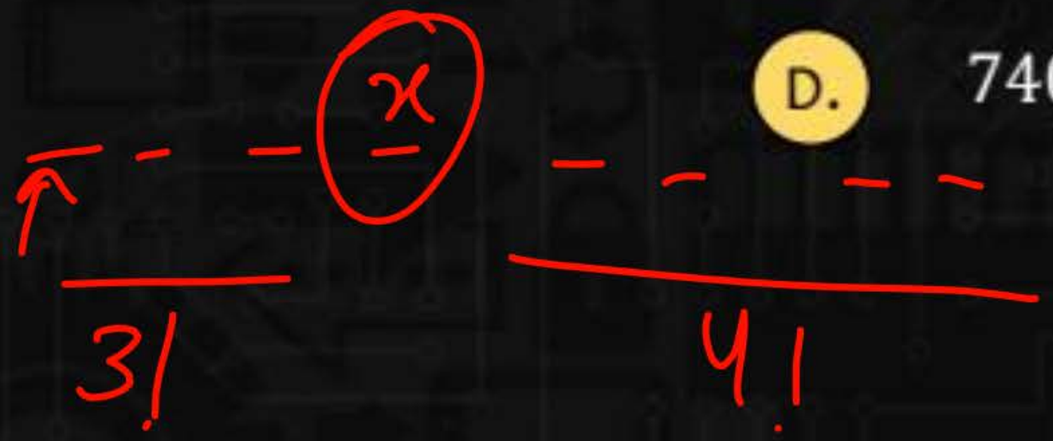
Quick sort partitioning algorithm is applied by choosing first elements as pivot element. Then what is the total number of arrangements of array integers are possible preserving the effect of first pass of partitioning algorithm. **[MCQ]**

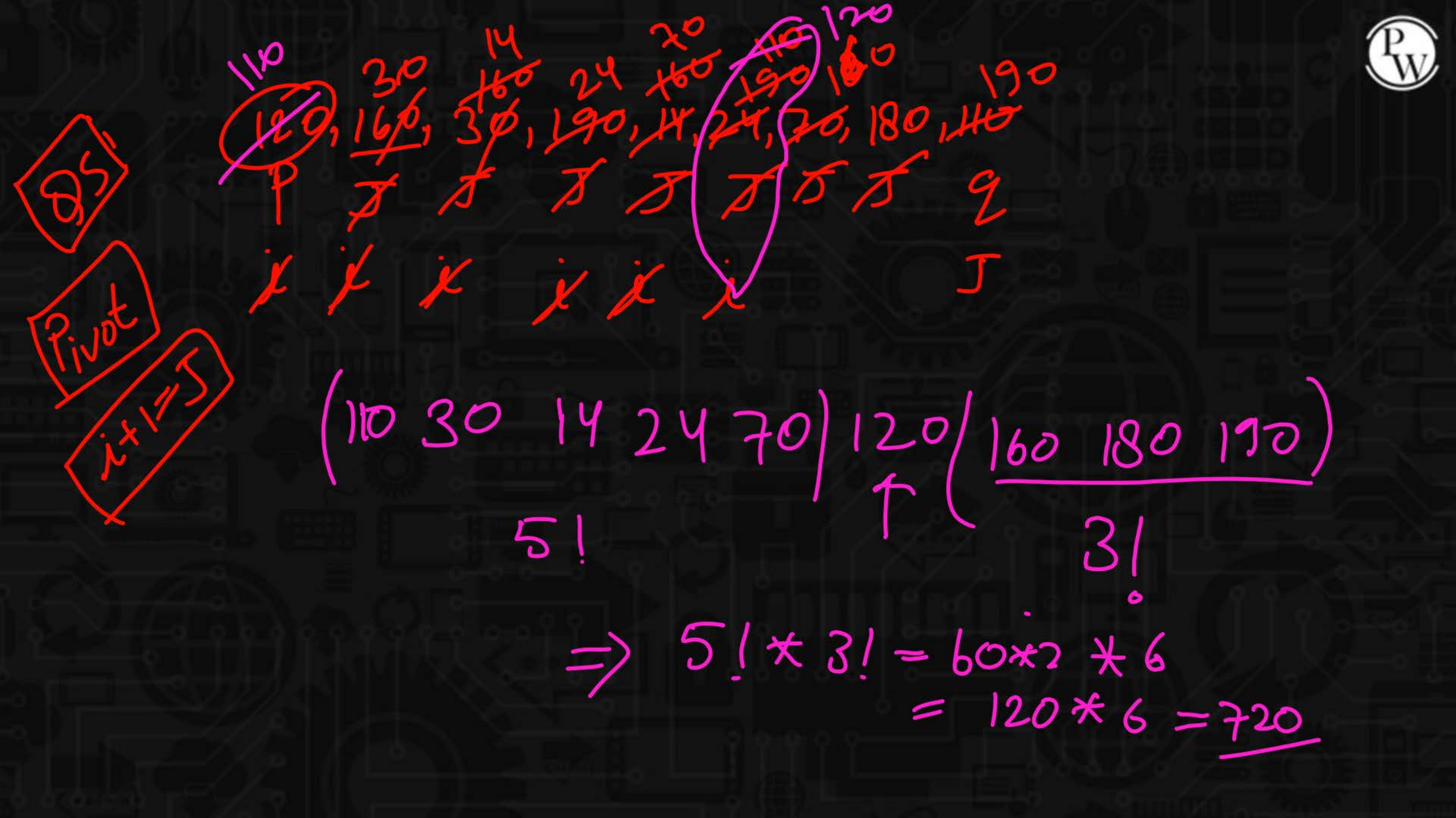
A. 680

B. 700

C. 720

D. 740




110 30 14 24 70 120 160 180 190
110, 160, 30, 160, 14, 160, 24, 160, 70, 120, 180, 190
P
i
j
BST
Pivot
i+1=j
(110 30 14 24 70) 120 (160 180 190)
5!
3!
⇒ 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. $O(n^2 \log n)$

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

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

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

$$\log m^k = k \log m$$

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

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

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

$$\Rightarrow 2 n^2 * \log n + n \log n + \log n = O(n^2 \log n)$$

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]

two merge algo

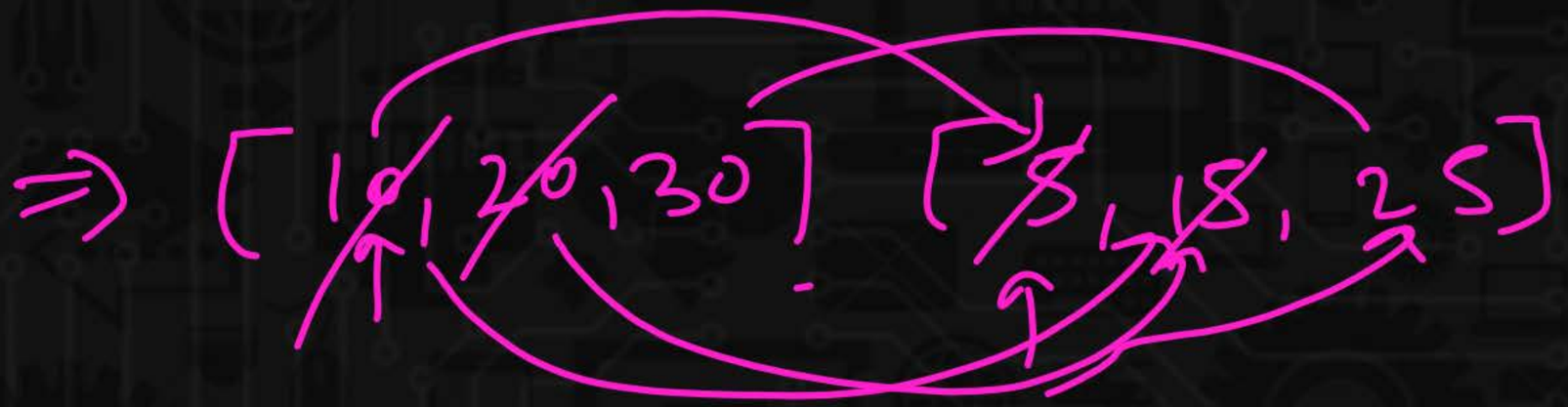
merge font

A. $2n - 3$

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

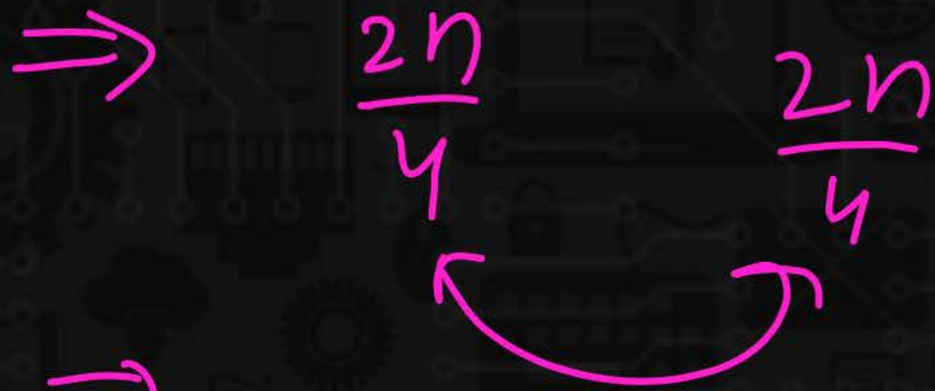
C. $\frac{9}{4}n - 3$

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


⇒ [10, 20, 30] [5, 15, 25]


5
10
15
20
25
30

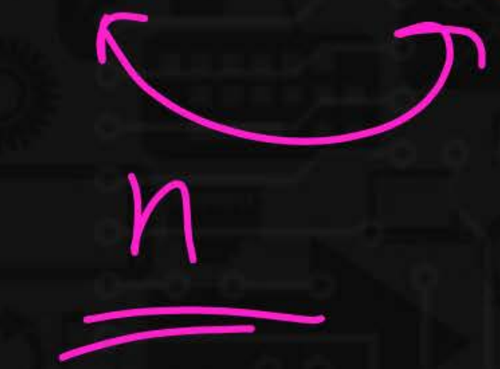

5
6 != 5
min = max



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

(n-1)

$\Rightarrow$



n

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

$+n-1$

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

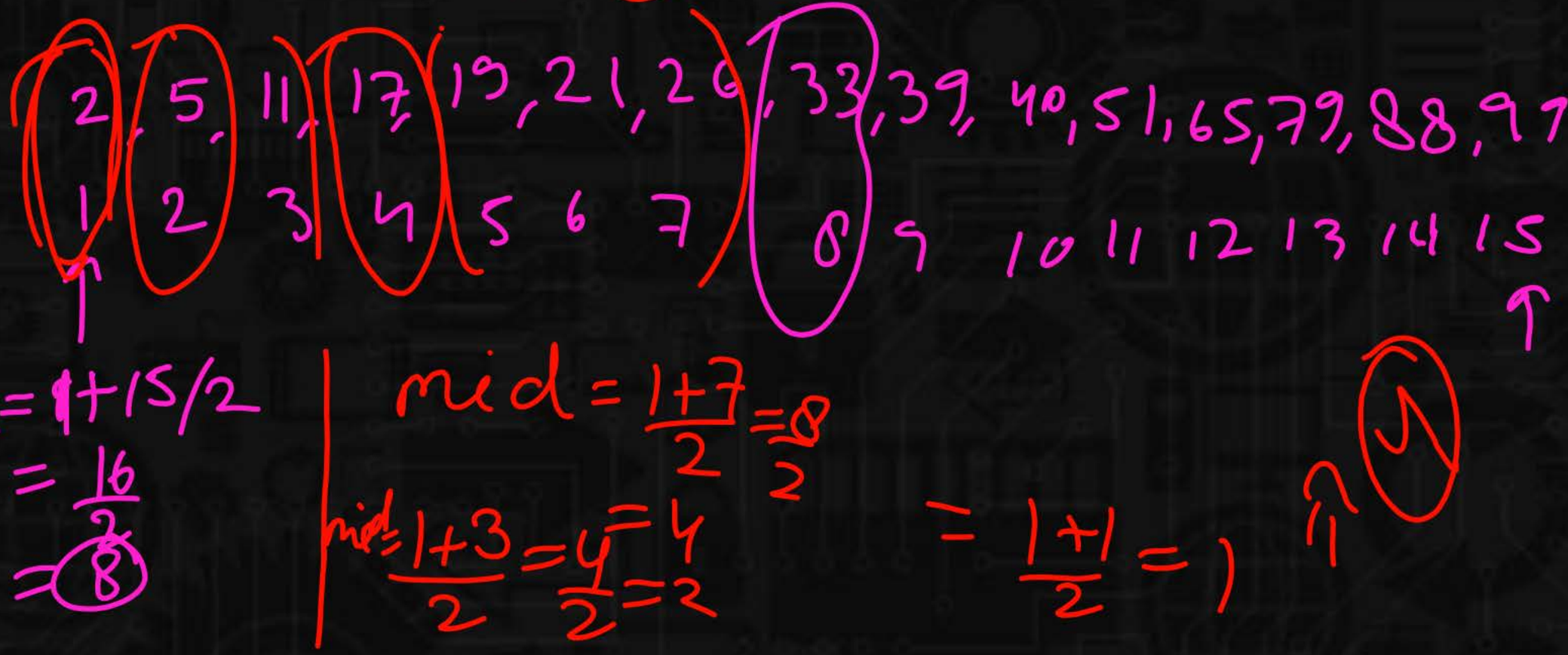
$= 2n-3$

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]**



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)

Comp = 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

BS $TC = O(n \log n)$

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

50 sec = 4482.89

for 50 names

BS $TC = 50 \log 50$

$= 282.19$

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

$= 3.147 = 3.14$ 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 ⇒ 81 + 89

+ 171

= 260 + 81

⇒ 341

82 90

172


THANK YOU GW
SOLDIERS !