June 2025

wk	M	T	W	T	F	S	S
22/27	30						1
23	2	3	4	5	6	7	8
24	9	10	11	12	13	14	15
25	16	17	18	19	20	21	22
26	23	24	25	26	27	28	29

06

2025
Tuesday
May

06

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9:00 **Q(21)** Option b is incorrect for $a = b$.

$\therefore$

$$\boxed{GCD(a,b) \times LCM(a,b) = a \times b}$$

11:00

Q(22) $f(n)$ is $O(n^2)$ and $\Omega(n^2)$ both

because n^2 is the leading term.

Q(23) Master Theorem says,

$$T(n) = a\,T(n/b) + f(n)$$

where, a = no. of subproblems

b = factor by which input size is divided.
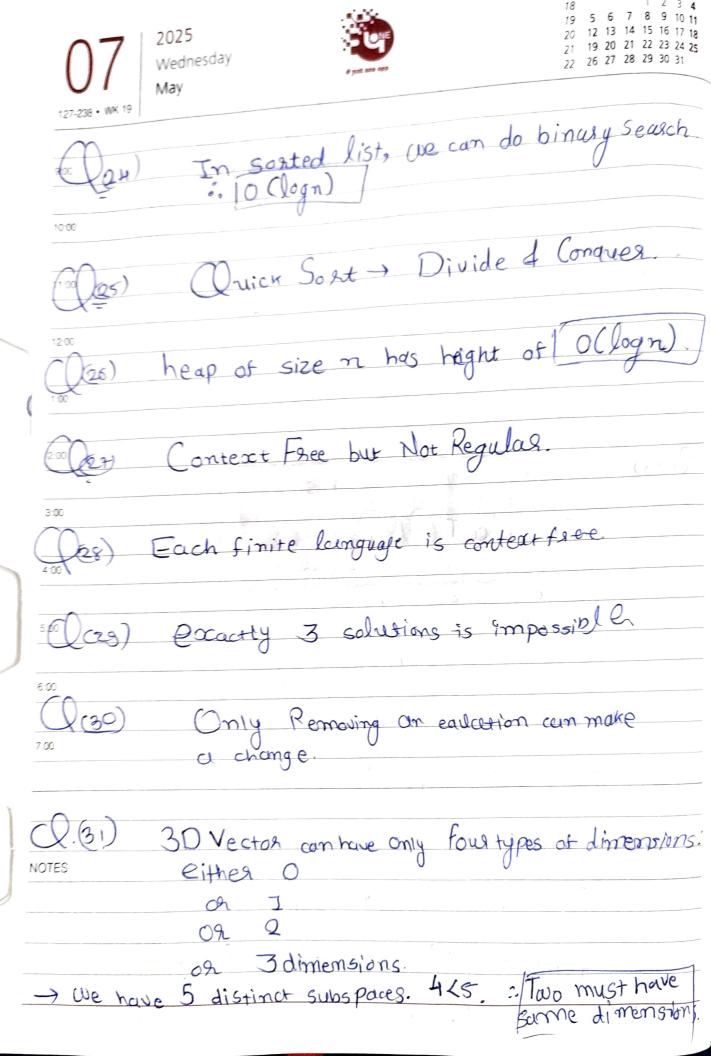
$f(n)$ = cost of dividing the problem and combining the solution.

here, we compare,

$f(n)$ with $n^{\log_b(a)}$

if, $f(n) < n^{\log_b(a)} \rightarrow T(n) = n^{\log_b(a)}$

$f(n) = n^{\log_b(a)}. \rightarrow T(n) = n^{\log_b(a)} \log n$

$f(n) > n^{\log_b(a)} \rightarrow T(n) = f(n)$

here, case 2. $(\because a = 2, b = 2)$. $\therefore \boxed{T(n) = \theta(n \log n)}$

07 2025 Wednesday May

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18
19 5 6 7 8 9 10 11
20 12 13 14 15 16 17 18
21 19 20 21 22 23 24 25
22 26 27 28 29 30 31

Q(24) In sorted list, we can do binary search
∴ $O(\log n)$

Q(25) Quick Sort → Divide & Conquer.

Q(26) heap of size n has height of $O(\log n)$.

Q(27) Context Free but Not Regular.

Q(28) Each finite language is context free.

Q(29) exactly 3 solutions is impossible.

Q(30) Only Removing an equation can make a change.

Q(31) 3D Vector can have only four types of dimensions.
either 0
or 1
or 2
or 3 dimensions.
→ We have 5 distinct subspaces. 4 < 5. ∴ Two must have same dimensions.

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Q.(32) "In Vector space, a set of non-zero, pairwise orthogonal vectors is always linearly independent."

linearly independent $\rightarrow$ L spans V $\otimes$
L spans V $\rightarrow$ linearly independent $\otimes$
L spans V $\rightarrow$ pairwise orthogonal $\otimes$

But,
pairwise orthogonal $\rightarrow$ linearly independent $\checkmark$

Q.(33) TCP RTT estimation using Exponential Weighted Moving Average (EWMA).

$$\text{Estimated RTT}_{new} = (1-\alpha) \cdot \text{Estimated RTT}_{old} + \alpha \cdot \text{SampleRTT}$$

$\alpha = 0.125$

$\text{Estimated RTT}_{old} = 320$ ms.

$\text{SampleRTT} = 400$ ms.

$\therefore \text{Estimated RTT}_{new} = (1-0.125)320 + 0.125 \times 400$

$= 0.875 \times 320 + 0.125 \times 400$

$= 280 + 50$

$= \boxed{330 \text{ ms}}$

NOTES

09 | 2025
Friday
May

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wk M T W T F S S
18   1 2 3 4
19 5 6 7 8 9 10 11
20 12 13 14 15 16 17 18
21 19 20 21 22 23 24 25
22 26 27 28 29 30 31

9:00 Q(3n)

Binary exponential backoff after n collisions means :

10:00

- Each station chooses a random number k from the range $[0, 2^n - 1]$

11:00

12:00   - It waits for $k \times$ slot time

1:00 After 2 collisions, on the 3rd attempt, the backoff range is :
$$k \in \{0, 1, 2, 3\} \qquad (\text{i.e., 4 choices})$$

2:00

3:00 So, for each station the chance of picking any backoff time is $1/4$.

4:00

- Probability that one station (Station A) succeeds :
A & B both randomly pick a number from $\{0, 1, 2, 3\}$

5:00

A succeeds if its number is strictly less than B's. Because it transmits first, then succeeds.

6:00

7:00 Total no. of distinct (A, B) pairs = $4 \times 4 = 16$.
Favorable cases = A picks less than B.

Count favourable pairs :

A		B have choices
A = 0	,	B have 3 choices
A = 1	,	2
A = 2	,	1
A = 3	,	0

6 choices.

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9:00

→ Same applies if B succeeds.

10:00

∴ Total favourable = 12.

∴ Probability that one Station succeeds = $12/16$ = $\boxed{3/8}$

12:00 Q (35)   NAT translation table :

1:00
$$(\text{private IP}^{\text{source}}, \text{private Port}) \leftrightarrow (\text{NAT Public IP, NAT Port})$$

2:00 ∴ Answer - ⓓ

3:00 Q (36)   SYN = 1 , FIN = 1

4:00
Start connection   Close connection

Can't be together !

Sunday 11

Q. (37)   Natural Outer joins using all common columns

$\{(1,2,5), (1,2,5), (3,4,6), (\text{NULL}, 7, 10)\}$

NOTES

Q (38) :   D & E are not present.
So, only   A → A,   AB → B,   AC → C.

Q (39) $T_1 \cap T_2$ forms superkey of R.
∴ Rating → hourly wages.

Q (40) Initial values $A = B = C = 25$.
T_1 adds 500,
T_2 doubles,
T_3 multiplies by 10.

$R_1(A), W_1(A)$ → T_1 reads A, writes A → $A = 525$.

$R_2(A), W_2(A)$ → T_2 reads A, writes A *2 → $A = \boxed{1050}$

$R_2(B), W_2(B)$ → T_2 reads $B = 25$, writes $B = 50$.

$R_3(C), R_2(C), W_2(C)$ → R_3 reads $C = 25$, R_2 reads $c = 25$, W_2 writes $C = 50$

$W_3(C)$ → writes $C = 50 \times 10 = \boxed{500}$

$R_1(B), W_1(B)$ → T_1 reads $B = 50$, writes $B = \boxed{550}$

NOTES