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Tutorial-2 DAA

Ans. 1

$j=1$ $\quad$ $i=1$

$j=2$ $\quad$ $i = 1+2 = 3$

$j=3$ $\quad$ $i = 3+3 = 1+2+3$

.
.
.

$j=k$ $\quad$ $i = 1+2+3+\cdots+k$

as $i<n$

Sum of k consecutive integers $= \frac{k(k+1)}{2}$

$\therefore \frac{k(k+1)}{2} < n$

$\frac{k^2+k}{2} < n$

→ after removing constants:

$k^2 < n$

→ $k < \sqrt{n}$

$\therefore T(n) = O(\sqrt{n})$ Ans.

~~Ans 3 $T(n) = \theta(n^3)$~~

Ans. 4 $T(n) = 2T(n/2) + cn^2$

Using Master's method $T(n) = aT\left(\frac{n}{b}\right) + f(n)$

$a \geq 1$, $b > 1$, $c = \log_b a$

$c = \log_2 2 = 1$

$f(n) > n^c$

$T(n) = \theta(f(n))$

$\Rightarrow O(n^2)$

Ans.

Ans. 5

i	j
1	1, 2, 3, ... n times
2	1, 3, 5, 7, ... n/2 times
3	1, 4, 7, 11, ... n/3 times
⋮	⋮
n	j = 1 — 1 time

$T(n) = n + \frac{n}{2} + \frac{n}{3} + \frac{n}{4} + \cdots + 1$

$= n\left(1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \cdots + \frac{1}{n}\right)$

$\Rightarrow T(n) = n(\log n)$

Ans.

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Ans. 6 $T(n) = 2, 2^k, 2^{k^2}, 2^{k^3} \dots 2^{k^{\log_k(\log n)}}$

as we know, $2^{k^{\log_k(\log n)}} = 2^{\log n} = n$

$\therefore$ total iterations $= \log_k(\log(n))$

$\therefore T(n) = O(\log_k(\log(n)))$ Ans.

Ans. 8 (a) $100 < \log(\log n) < \log(n) < \log^2 n < \text{root}(n) < n < n\log n < n^2 < 2^n < 4^n < 2^{2^n} < \log(n!) < n!$

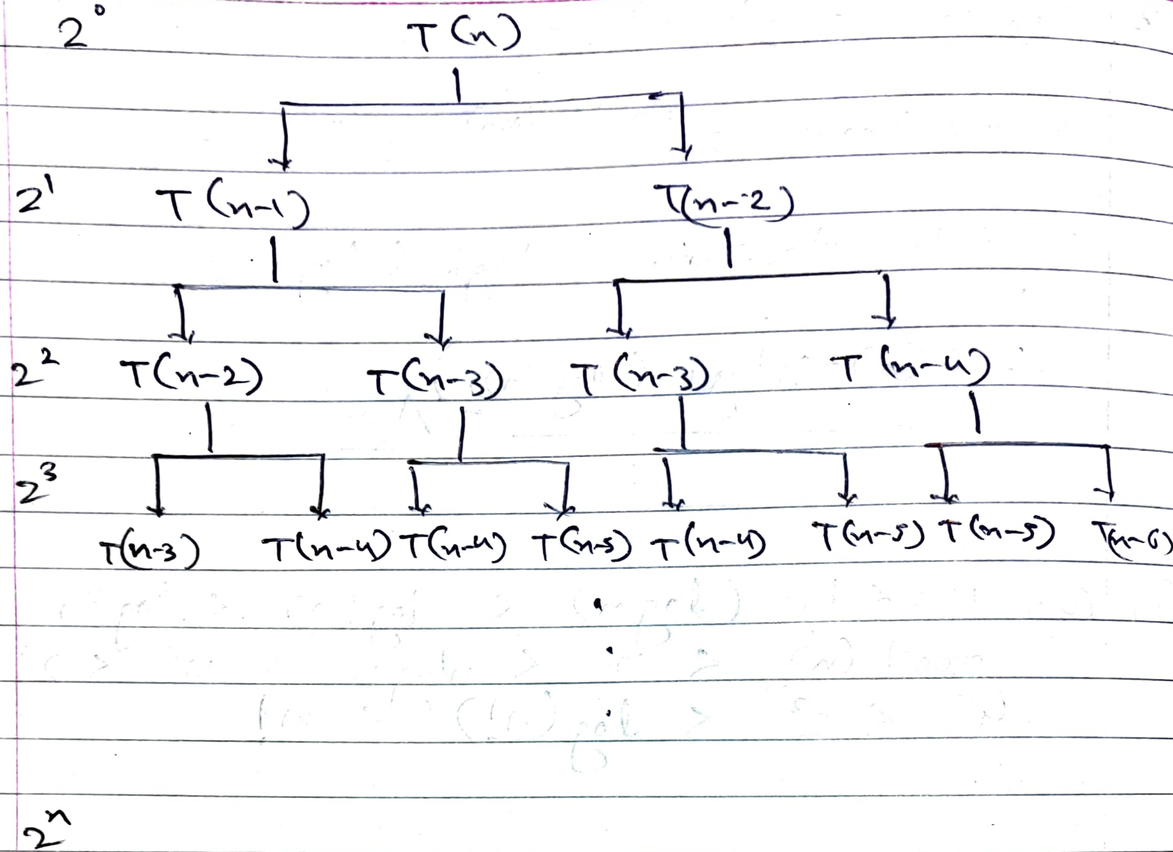
(b) $1 < \log(\log(n)) < \sqrt{\log n} < \log n < \log 2n < 2\log n < n < 2n < 4n < n\log n < n^2 < \log(n!) < n! < 2(2^n)$

(c) $96 < \log_8(n) < \log_2(n) < 5n < n\log_6 n < n\log_2 n < n! < \log n! < \cancel{8^{2n}}\ 8^{2n}$

Ans. 2 Recurrence relation of fibonacci series:

$T(n) = T(n-1) + T(n-2) + 1$

P.T.O.



$T(n) = 2^0 + 2^1 + 2^2 + 2^3 + 2^4 + \cdots + 2^n$

now sum of GP $= \dfrac{a(r^n - 1)}{r-1}$

$a = 1$
$r = 2$

$\dfrac{1(2^n - 1)}{1} = \dfrac{2^n - 1}{(2-1)}$

$T(n) = O(2^n)$ Ans

Space complexity depends on the deapth of the tree.

$\therefore$ Space comp. $= O(n)$ Ans