

PART I: Recumances

 $\int I(n) = I(n-3) + 3\log n$   $\int I(n) = I(n) = O(n\log n)$   $= \int I(n) = Cn\log n \quad \text{s.t.} \quad c.>0$ T(n) = T(n-3) + 3/09 n - HANGE STORY => c(n-3) log(n-3) + 3logn

∠ ((n-3) logn + 3 logn

4 Cologn -c3logn + 3logn

Removing lower order tems

= Cnlogn

buses T(n) = O(n'03 4)
Poroue T(n) = cn'03 4 2) T(n) = 4T (n/3) +n

 $T(n) = 4T\left(\frac{\eta}{3}\right) + n$   $= 4T\left(\frac{\eta}{3}\right)^{\log_3 4} + n$ = 4 Cn 1093 + 1 310934 = 1/4 Cn 10934 + 1

3) 
$$T(n) = T(n/2) + T(n/4) + T(n/8) + n$$
  
Guess  $T(n) = \alpha(n)$   
=>  $T(n) = \alpha(n)$ 

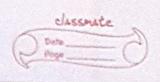
$$= T\left(\frac{n}{2}\right) + T\left(\frac{n}{4}\right) + T\left(\frac{n}{8}\right) + n$$

$$\frac{2}{2} + \frac{Cn}{4} + \frac{Cn}{8} + n$$
 $\frac{2}{4} + \frac{C}{16} + \frac{C}{64} + \frac{C}{10} + \frac{C}{10$ 

4) 
$$T(n) = 4T(\frac{n}{2}) + n^3$$
  
Show  $T(n) = O(n^2)$ 

$$= 4T\left(\frac{n}{2}\right) + n^3$$

$$\leq 4 C (\eta_2)^2 + n^3$$



4 C n/4 +n3

bl Go (C+n) n2

T(n) = Gn2

PART - 2. 1) T(n) = 3T(1/2) + n2

x) a=3, b=2.

n log2 is less tha n2

T(n) = 0 (n² log °n)

 $= O(n^2)$ 

2)  $T(n) = 2^n T(\frac{n}{2}) + n^n$ 

This Connat be solved by master thecouns as we cornat find the Inequality of a, b & n.

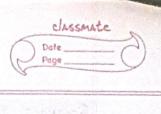
3) T(n) = 3T(n/4) + nlog n  $a = 3, b = 4, n \cdot nlog n$ 

n logn ≈ nlogn birce nlogn is greater we use MT 3

= 0 (n'log'n)

1(n) = O(nlogn)

	Page
41	I(n) = rI(n), h
7)	$T(n) = 2T(n) + h$ $\log n$
	=) 27(n)+nlogn
	2 (2) 1119
	a-2, b-2
	=) nloga znloga
	n = n
	n = n hone we use MT 2.
	T(n) = O(stog n log2 (og logn)
	= O(nloglogn)
	T(n)= O(nloglogn)
5	$T(n) = 0.5 T(\eta_2) + 1/n$
	We Consat Lalue this using master theorem.
	Theorem.
	1267 - (4) 100 - (4) 100
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44.6	Marie Marie Calendar



PART - 3 How would you represent a d-ary heap

Ans: The d-ary heap can be considered similar to a kinary heap with Parent indexes and child Indexes

jth-Child: d.[i+j] where j=0---d=1
The most would be at index i=1

Q.2 A Long d-any heap height -> O (logn)

1+d+d2+---dh-12n - 1+d+d2+---+dh

 $\frac{d^{h}-1}{d-1} < n \leq \frac{d^{h+1}-1}{d-1}$ 

dh = n(d-1)+1=dh+1 -- halloged 141) 250

h = [(log(h(d-1)+1)-1)]

Q.3 HEAPIFY (A,i,n,d)

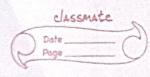
for K= 0 & d=1

if dxi+K = n and A [dxi+K]>A[j]

then j = dxi+K

then Exchange A[i] ↔ A[i]
HEAPIFY (A,j, N,J)

	Classa
	Date Page
	Ludg Ludg
	EXTRACT MAX (An)
	man (H,n)
	$max \in A(i)$
	A[2] (-A[n]
	n= n-1
	HEAPTEY (A. 1 nd)
	Tet.
	netwen max
	The Gunning time of 11 11 11
	is O(21 n) the Heapily algorithm
	8.
	airee en Extract - max me hane only
	Constant work.
	The sunning time of the Heapily algorithm is O(dlogh). Since in Extract - max we have only Constant work. The total sunsing time
	The total running time is
	Old log h)
cΛ	PART-3
6	Insert (A, K, n,d)
	n = n + 1
	A[n]: Max
	Increase-Key (Ai, K, n)
	Forom & The surning Time
	of Increase - Key is Ollerh) & N.
	most we are
	Increase - Key is O (logh), & dince in Insert we are not looping and just adding 20 the total nunning time  Page 2
	acaing 20 the load gunning time
	would be O(log 1)
	[HR] -3
Q5.	Increase-Key (Aij)
	A[i] < max (A[i],k)
	if K=A[i]
	while $i \ge 1$ and $A[i] \le A[i]$ $i \leftarrow [i/d]$
	$i \leftarrow [i/d]$ [a]



The Implementation loops proportionally to the depth of the tree, therefore & I the ourning time O(logn) time.
at each step the loop checks the it pode to ils
Parent oro; node and sugges them if it is found
to violate the heap property So the sunning time will be O(logn) We know cell elements are equal. So the Randomized RANDOMIZED-QUICKSORT will always lead to result 9 = 8. Then the surning time will be recurrence of Same  $\Rightarrow$  T(n) - T(n-1) + O(n)= 9(n²)// PARTITION (A,P,r)

22. PARTITION (A,P,r)

I = A(P)

low = P

high = P

for j=P+1 tor if A[j] -x

y = A[i] A[j] = A[high+1]

A [high +1] = A [low] A [low] = Y

low = low + l high = high + l

else of A[]==X

exchange A Chigh +1) ex A [j]

high = high +1

return (low, high) QUICKSORT (A, P, r) (low, high) = RANDOMIZED-PARTITION'(A.P.X) BUTCKSORT' (A.P. low-2) QUICKSORT' (Ashigh + 1, Y)