Retike Verma Source 6 Tech (CSE) sec- B

Hssignment 1

all what do you understand by a symptotic notation refine different asymptotic notation with example. Ans. Asymptotic notations were the mathematical notations used to describe the ourning time of an also when the i/h itends towards a facticular value or a limiting value

- There are mainly 3 Asymptotic notations: -Link not 1 a Ves Sangen son for

(1 1 Kig-0-notation

. It represents the appear bound of vurning time of an algo.

· This notation is called ac upper bound of the calgo, or a worst

case of van valgo · O(g(n)) = (f(n): there exist positive constants c & no which that 0 \f(n) \langle (g(n) for oll n) no, where c>0 & n) no

3 clag n + 100 <= (c\*(log(n)) 1 /1 c= 1<0 & n>2

(undefined at n=1)

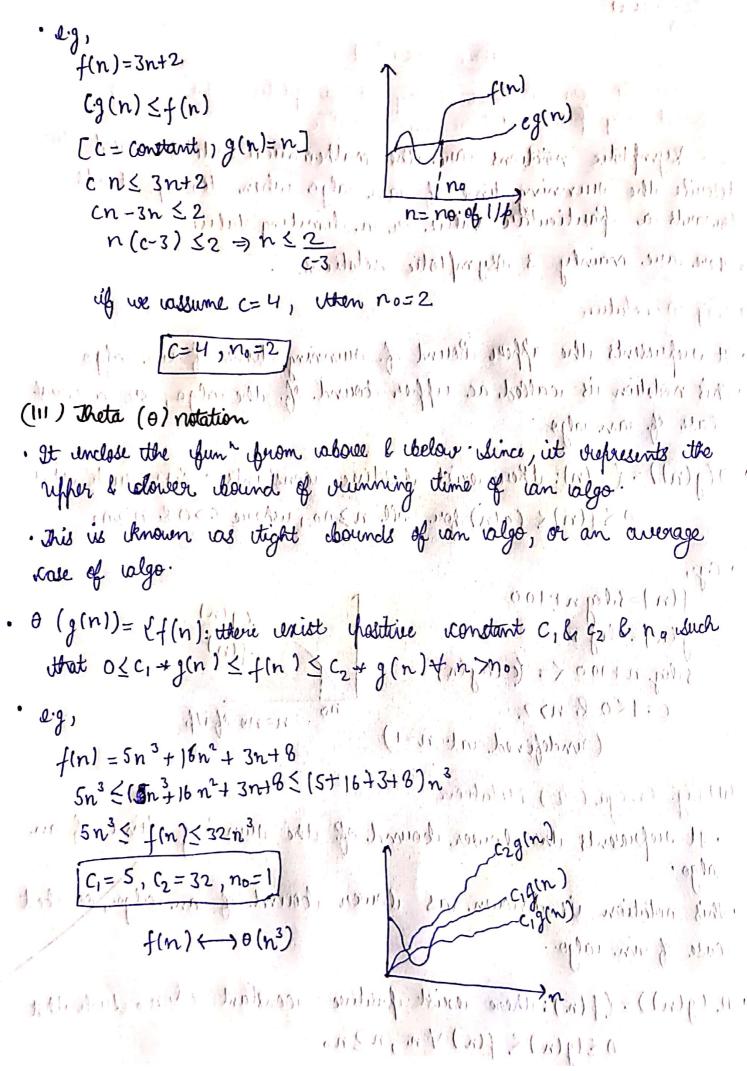
1019 (n)=clog n 10 101/2000 sinte 12/200 ((11)) ( n=no. of i/p

that I add o not all

. It referents the lower bound of the ounning time of an

. This notation is known as dower bound of an valgo, or best case of an ialgo.

. r (g(n)) = (f(n): there exist faitive constant con o which that 0 s (g(n) & f(n) \tan, n \range no



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Os2. What should be the time complexity:
     for (i=1 ton) (i=i+2)
                                   1011 1011
ans i=2,4,8,16, ----- Kth cteum +----n
        Gn = asi
        9n = 1(2)K-1
                                      ATT. THE
        n= 2 1
        Jog2 n = (K-1) Jog22
          K= log2n+1
                                      1-(11)111 -1111
           0(n)= dogn
                              1-(1-12-11) 9812 5-(11)1
 Oss? T(n)= (3T(n-1) if n>0, otherwise 13(111) The (11)
                       1- (2-11) 12 + (2-11) 1 -
 Que> T(n)= 3T(n-1)
               _T (n-1) = 3T (n-2) (1-(1-11) 15) 3 (11)
                              T(n)=3x3T(n-2)
                 -7(n-2)=37(n-3) (17)
                     T(n)=3x3x3T (n-3)
       T(n)= 33 T (n-3)
                          1.3 2 3 28 (1901 1 2 201)
                TIn-3) = 37(n-4)
       T(n)=33x37 (n-4)
                                 Menting & Bonne
       T(n)=34 xT(n-4)
                                   1011 (11)
       general form: -
        Tinl = 3i T (n-i) _ __- - 110 (ET(0)=) ] (0)
         T(n-i)= T(0)
          n-i = 0
           n=i
                               (1-13) 1-12 (11)1
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lutting n=i un ugh li)
          T(n)=3^nT(n-n)
                        [T(0)=1.guem]
          T(n)=3" T(0)
          T(n)=3h
           T(n)=0(3")
       T(n)= (2T(n-1)-1, if n>0, otherwise 1)
  Q347
        T(n)=2T(n-1)-1
ous >
                                        sites of us
               T(n-1)=2T(n-2)-1
        T(n)=2^2 T(n-2)-2-1
        T(n)=2 X(2T (n-2)-1)-1
        T(n-2)=2T(n-3)-1
T(n)=2^{2}(2T(n-3)-1)-2-1
T(n)=2^{3}+1
         T(n)=2^3T(n-3)-2^2-2-1
                  T(n-3)=2T(n-4)-1
         T(n) = 2^{3}(2T(n-4)-1)-2^{2}-2-1 (1-11) T(x_{1}) = (x_{1})^{2}
                                         (111) 718 91111
          T(n) = 2^4 + (n-4) - 2^3 - 2^2 - 2 - 1
                           (1.11) (12.11)
                                      (1.11) 11) 11 1111
         June 12 1 (n-i) - (2i-1+2i-2+-..+)
         general form: -
           T(n-i)= T(0)
             n-i=0
             n=i
       T(n)=2^{n}T(0)-(1+2+2^{2}+2^{3}+--2^{n-1})(1-11)
       T(n) = 2^{n}(1) - (1+2+2^{2} + ---2^{n-1})
         T(n) = 2^{n} - 1 \left(2^{n-1} - 1\right)
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	8147 3
$T(n)=2^{n}-2^{n-1}+1$	The state of the s
$T(n)=2^{m-1}(2-1)+$	L qui Pla (138)
$T(n)=2^{n-1}+1$	11-24377 11
$T(n)=0(2^n)$	(1) (11) ns ( 212 - 11
Interior	(1)
OBS) what should be the	e T.C of:
wit i= 1 , s=1;	
while (s<=n)	5(81)1115
E	
i++;	1 - 1(81) 1 11 = 1 - 2
S=S+i;	(2)1 $(R)$ 1
funity ("#");	(x)' = (x) + (x)
J	
ones No. of Utils S	(75)10 - (71)T
(K),	1
1	2 ( 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
2 3	3
3 6 lo	5
	6 (11) (27)
5 15 21	7
	ica divide , to a mount private to a sinde of
Kittel I'm	of action prince brance or so of going or
T(n)=0(K)	17
	( int) ( in) [
s= 0,1,3,6,10,-	
Sn. = 1+3+6+1	0+15++n
Sh = 1+3+	6+10++(n-1)+n
-/	
0 = 1+2+3	3+4+5+n

n= 1+2+3+4+ -- -- Kutel 1 2 1 - 2 1 16.13 1911 og i delle n= K [2(1)+(K-1)1] 1 4 " = 6,011 2n=K[2+K-1] Jenje-1, 11,  $2n = K^2 + K = 2n - (K + \frac{1}{2})^2 - (\frac{1}{2})^2$  $2n+\left(\frac{1}{2}\right)^2=\left(\frac{1}{2}\right)^2$ 1 1 1 1 1 1 1  $K+1_{1} = \sqrt{2n+(1/2)^{2}}$  $K = \sqrt{2n+(1/2)^2 - 1/2}$ T(n) = T(K) $T(n) = T \left( \sqrt{2n + (1/2)^2} - 1/2 \right)$ T(n)=0/n 086) T.C off:void function (unt n) unt i, count = 0; for (i=1; i+ i<=n; i++) Count ++ ons dince, i is moving from 1 to m with ilinear growth wo, T(n)=0(vn) (2)0.111 10. --- 10119 11 110 . . West (1-14) 11 -- 101 4 8 4 1

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The state of a second restaurance
(B7) Jime Complexity of
                                       1119 . (1-11)
    void function (unt n)
                                    19-1-71 C 19:00 .
     unt i, j, k, court=0;
                          of file mi) of grad (1-30) - mi) To finite
    you (i= n/2; i/=n; i++)
    Gor (j=1; j < =n; j=j+2)
                            - A 2 1 21 1 1 1 - (11) 1
     for (K=1; K &n, K= K+2)
                                dung funder elmi
     count ++;
                                    (E) (n) T
ans O(ndgn dgn)
     o(n(dgn)2)
                                Andrew mil in to
     Time complexity of
                                      11/01/11/11/01
      function (unt n)
                                11999
      if (n==1) voturn;
      for (i=1 don)
                                            (1000)0
       ( for (j=1 tto n)
       function (n-1); )
uns T(n)= T(n-1)+n2 [T(n-1) =T(n-2)+(n-1)]
   T(n) = T(n-2) + n^2 + (n-1)^2
                     [T(n-2) = T(n-3) + (n-2)^2]
   T(n) = T(n-3) + n^2 + (n-1)^2 + (n-2)^2
  yeneral Term:
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T(n) = T(n-i) + n^2 + (n-1)^2 + (n-2)^2 + --- (n-i)^2
      T(n-i) = T(i)
       h= i+1 => [n-1=i]
    T(n)=T(n-(n-1))+n^3+(n-1)^2+(n-2)^2+---+(n-(n-1))^2
     T(n) = T(1) = n^2 + (n-1)^2 + (n-2)^2 + ---1^2
      T(n) = 1 + 1^2 + 2^2 + 3^2 + - - - - + n^2
       T(n) = \frac{n(n+1)(2n+1)}{1}
                                                4 1 1 mm
         T(n) = \alpha(n^3)
                                             (ally release)
 Qsq. TC of:
                                             ("(Map) 1/1)
     void function (unt n)
    for (i=0 to n) {
                                        The state of the state of
    (for (j=1;j<=n;j=j+i)
     fruit ("#");
                                        (not in the second
     77
unes o (nota)
                                        Os10) For the fun nk &an, what is the asymptotic violation blu
  these function? Assume that K>=1 ba>1 were constants.
   Find out the value of cl no for what vielation holds.
dres of c>1 then the eaponential cn for outgrows any down,
     No that vansiver is: 11) ! !!!!!
           nx is o (cn)
                              1. (11) 4, 21 18 7 (11) 1 · (11) 1
                             1(1) 1 (14-3) 4 (2-11) 4 (14-1)
```

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Obl : What is the T.C of code & why?
    ( with my bid
     unt j=1, i=0;
                          of the war of the and the same
     while (i<n) {
                                  5 (1-12) . (11) det
        i=i+j;
        1++; 24
                                       3-13111 SAMT
 ans i=0,1,3,6,10,15, ----
     No, i hill you on till n & yaneral yournula
                                                 (2) F.
      for Kth town is n= K(K+1)
        :. T. C = O(Jn)
 OS12. Write the recurrence relation for recursive function that
   feints fibonacci series solve recurrence relation its yet T.C. of fregram what will be the space complexity of this fregram
 & why?
( rele di soismingu Joan rath )
            T(n-2)≈T(n-1)
       T(n) = 2T(n-1)+C
                         I will had a ward of graph to
                 (n-1)=2T(n-2)+C
                                                  July 1 6
        T(n)=2 (2T (n-2)+c)+C
                                               ( Jan line
        T(n)=2^2 T(n-2)+2 C+C
                                               44 1 die
                 LT(n-2)=2T(n-3)+C
                                        (might shirts) M
       T(n)=23(2T (n-3)+C)+2C+C
        T(n)=23 (T(n-3)+22C+2C+C
                                       ("11") 1 Live
                                          TY 4"11 4 1 1 1 1
       djeneral Jenn: -
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 $T(n) = 2^{i} T(n-i) + (2^{o} + 2^{i} + 2^{2} + -... 2^{i-1}) c$ T(n)= 2" T(0)+ (2"+2+2"+ -..2") C  $T(n) = 2^{n} (1) + 2^{n} (2^{n-1} - 1) c$ Partition of the T (n)=2" (1+c)-c - - 1. 1. 1. 1. 1. 1. 1. 1. 1. T(n)=0(2") (147) 7 . 31 32 mint 19 36 fil (6) (M)0 - 5.7 .. ு. ஆர். இது இருந்து ஆர். முர் ஆர். முர் A state of war state that the Drive Spale respective The man depth is proportional its N, whence the space compo of Fibonaui recuries is 'O(n). (1-11) 2 (1-11) OS13) Write perograms which have T.C:- 11(1-11) 15 1 (11) 3 ( ( ( W) ) 5 ( ( W) ) . ) w nlgn 11 ( ) ( dep) 1 d | 8 e ( K) ! void fun () 11115 1 118 3) 12 CFC unt i,j; Citize Harristo for (i=1;i <=n;i++) 11/1/2 2 (31 (N-3) 16) 12 CI for (j=0; g<=n; j=j+2) found+ ("#"); funt ("\n"); yy Derent Best -

```
(II) h3
   void fun (unt n)
     uit i, j, Kj
     for (i=0; i <=n; i+t)
                             (1111) (2111) (2111)
      for (j=0; j <= n; j+1)
                             a mes a me t'm Delm) !
     for (K= 0; K<= n; K++)
                             1 (11) + 12 (11) 1 (11) 1 (11) 1
     frint ("#"); yyy
 (iii) log(log(n))
                                      (10 ml) 1017
    void fun (int n)
    bool frums [n+1];
                                           (1 ( In ) m) 10
      membet (fouris, totale, size of (fume));
       for (unt h=2; h+h <= n; h++)
                                1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
        uf (forme[f]==tome
                                          Man' (1) 33
        for (int i= p + p; i <= n; i+= p)
         cheunie [i] = false;
                       is for the propries but is described, it directed
        for (unit h=2; h <= n; h++)
         if (forme Cf) in strong is strong in line (Cf) amust, for ist
           cout << p << endl;
      T(1)=C
(CAND)
                     alvi - - - Aglaid & Wild on a sout solo
       n=n/2
      T(n/2)= T(n/8) + T(n/4) + ( (n2/4)
                    Aughor (n)
```

T(n)= T(n/4)+2T(n/16)+ ((n2/16+n2/4+n2) T(n/4) T(n/2) T(n/4)  $T(n)=C\left[n^2+\frac{Sn^2}{16}+\frac{2Sn^2}{256}+\cdots\right]^{(11)}$  $T(n) = n^2 C \left[ 1 + \frac{5}{14} + \frac{5^2}{16^2} + - - \cdot \right]$ T(n)= O(n2) (15 Just) 100 17 OS12) LC &:-: ( 145 ) small Jones . for (int j=1)j<n;j+=i) Sind - of Aloxing to 11 some 0(1) task (A 13/10 - > 1 : A + A - 1 kind of 77 Burnette) - Julie; ans for i=1, unner cloop is executed n times for i=2, cinner clock is executed riz times for i=3, inner look is executed n/3 times ( ) Coulded to Ask July for i=n, inner look is executed n/n times Jotal time = n+n/2+n/3+ - --- - n/2 =  $n(H \frac{1}{2} + \frac{1}{3} + \frac{--\cdot \frac{1}{2}}{n})$ =  $n \log n$   $|T(n)| = o(n \log n)$ 

OSIL) TIC Of: for ( wit i=2; i <= n; i= flow (i,K)) 1/20me O(1) expressions 100 × (11) 1. # 8 × 1 1 1 1. 1 101-11 19101 where, K is a constant ans > O(log(dog n)) OS18) Borrange in inc. order of viate of generath ( Int. ) I win waters (a) 100, dogdogn, dogn, stoot n, n, nlog n, n<sup>2</sup>,2<sup>n</sup>,2<sup>2n</sup>,4<sup>n</sup>,n! (1-11/11) diplimiters (16) 1, log (log (n)), log n, log (2n), 11 -11 1-1150 dog(n!),2dog(n), n,2n, 4n, ndog(n), n2, 2(2n), n! (e) 96, dog n, dog n, dog (n!), 5 n, n dog 6 h, |n log 2 n, B n2 1, 7n3, 82, n! 111/1/11/11/11 OSIA) Write Linear Bearch freudo code --ones Linear Search (A, Key) 111 /11/16 confered to only describe themsel from the the state of the constant of for i=1, to A: length sunly propolition direction realist soil in They super Time if A[i]== Key you sorred to per part part part fruit "Element found" July 210211 . i linkette, deret if f==0 feunt "Element not found" . obe dies sole. Dust Bent fourt comp OS 20) Write freudocade for ----· 10 · 10 · 10 Ans) Iterative Nethod of Insertion Sout-InsertSort (A)

for j=2 to A length Mariana in the same of the sam Key==A[j] i=j-1 and the state of while iso & A[1]> Key A [i+1]= A[i] 16 1 37 7 7 1=1-1 (Copt post A [+1] = Key Rocursive Method-> The state of the s Inertionslot (A,n) interior was jour water water to the if ns1 111, 11, 11, 11, 11, 11 voturn Insertionsort (A, n-1) of helping rates and getting the Key = [n-1] ingraps in apply when ingra (w) hoper (in) b. j= n-2 while j20 and ACj], > Keystar, 10 ((11)) [1] ACj+ 17= ACj] The street from the land j=j-1 The office on Bourse ( 18 ) Some A[j+1]= Key -> Insertion book workidors one if illement her interation & howdices a fartial edution without considering future relements that's why it is called online sorting. Other sorting algos that have been discussed in electure are:-· Bubble sout · Morge Sout · Selection Sort · Haf Sout · Ouch Sort Jan Darwitt " Drait · Counting Sort 0121) Conflexity of all sorting ---

A						
Ans:-	Cest rase	werage va	<b>s</b> e	Worst Case		
Bubble wort	T(N)	B (N1)		O(N <sup>2</sup> )		
delection sout	T (N3)	9 (Ns)		1 0 (412.)		
Insertion sout	v (n)	9 (Nr)		0 (N2)		
Magica	2 (Nlogn)	D (Nleg N)		0 (NJ&N)		
Hand o 1	e (Negn)	O(NlogN)	- 1	O'(NJogN)		
duck sout	r (Nlogn)	O (Negn)		O(N2) Marer Chine 12		
Wounting Sout		O (NHK)		V (VITA)		
•			ditto	0 (N+K) 100 - 1510 V		
O822) Divide all borting also into him minute						
Ons->	0 0			107 1 1 1500 ]/ 81.		
	In Clace	Stable	Online	14 him - pos.		
Bubble Sout	yps	yes	yes	Brack Private A		
Insertion don't	yes	yes		1. James Amb		
delection doct	yas	No	yes	1- wail ( ,		

N8-)	In Clace	Stable	Online 14 him pos
Bubble Sort Insertion Sort Selection Sort Merge Sort Ouick Sort Heaf Sort Vaunt Sort	yes yes No	yes No Yes No No	yes (1) - phint was said yes (1) - phint was said yes (1) - phint was said yes (1) Asyrate promits yes

0523) Write occursive iterative ----

Ans -> dinear blearch ->

Jinlandearch (A, Key)

found \( \in 0 \)

for i=1 to N

if A[i] == Key

found \( \in 1 \)

found ←1
found "Element found"

ative \_\_\_\_\_ with the prince of the sold of

break uf found == 0 - 4 als . 4 THE LAND SHEET faint " Element Not Found" A Maria and Salah 101111 Time conflority - Oln) Trip Bat pair 1-15) ( Space complexity - O(1) (Blin) . July (11 pol 12) ( A 10, 8 Birrary search (Sterative) -> (17 pol 19.) , 1 (1x by 13)1 Treat Fine (14 (311) 11 Binaryslanch (A, beg, and, Key) 1990 16) while beg & and (VIII), a doct prist (2119) x mid = useg + (and - useg) 12 if mid==key when opin problem to a some return mid if A [mid] < Koy cheg=mid+1 Title Shin. if Atmid ] Key 19 end = mid -1 that without 201 Icetum -1 stable with-01/ sine complexity - O(log, n) I red great offace complainty - 0(1) Trol, Arm Binary Bearch (Recursive) 1.10 Anti Binary Slarch (A, beg, and, Kay) 911 if and they mid = (log +and) 12 if A [mid] = = vitem god a strong skie i ratio 🐒 a bij outurn midt! A Amada A area celse if A[mid] < vitem Tyou, A Bound with return Birary search (A, mid+1, end, kg) to James 14 01 10 10 vieturn Birary Search (A, beg, mid-1, end) 110V = = 1 101 A I return - 1 Joseph Howall Som

Time Complexity - O(logn)
Whace Complexity - O(1)

Oszy) Woute oucurrence relation for chinary orecursive isearch one T(n) = T(n/2) + C.