

Space and Time complexity

Time complexity! = Time taken

- "Function that gives the relation about how time will grows as the infut grows.
- · Always look for worst case.
- · Always look for complexity for longer data.
- · Big-oh (0) (worst rase)
 - upper bound

A mathematical notation that describe the limiting behavior of a fund when argument tends toward a particular palue.

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Mathematically:	Table 1
A distribution of the second o	C. Inqu
f(m) = O(g(n))	طوسانا
	all accord
$ \begin{array}{c cccc} & lin & f(N) & \infty \\ & N + \infty & g(N) \end{array} $	remen.
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	n a politik
Enample:	r arss
f(N)=6N3+3N+5	(Those is a
$O(N_3) = O(N)$	in many
lin 6 n ³ + 3 n + 5	e la fin
N-+ W see a series of the second seco	est de la constant de
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	direction.
substituting the value	rouds de
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but 3 + S = 6	
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· Big - omega (12) (Bes	t case)
Lover bound	
· It will be never if le lower bound.	ssthan
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Mathemalicaly:	
	1. 1.
$a \rightarrow \infty$ $a(n)$	
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	0 0 .
Question: What if an a	go has
Question: What if an a LB & UB as (N2)	0
$= 0 (N^2) & Q (N$	12)
$= \Theta(N^2)$	
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· little o notation	•
)
Loose upper b	ound
Big oh	Little oh
f = o(g)	f=60(g)
· Growth of f	Strictly slower
· Growth of f is no faster than	Strictly slower than g
tige f=g	F-42g
	La Branche de la companya della companya de la companya della comp
Enample	
Example $f(n) = n^2$	$g(n)=n^3$
lim f(n)	$= N^2 - 1 = 0$
N+∞ g(n)	n3 h

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· little wa motation

Lossely Lower bound

Big 12

 $f = \Omega(g)$ $f \ge g$ little w

f = w(g) f > g

Enamble

 $\lim_{n\to\infty} \frac{f(n)}{g(n)} = \infty$

space complexity

· Input space + aunilary space

-> aunilary space (spentra space taken by algorithm)

i=1,1+K, 1+2K, + ... 1+nK

1+xK LN

N = N - 1www.yodlee.com

of loop is

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0 (Xt * (N	()
0 (t*(n-1))	
A (NIX)	ilate Lulhore += 1
0 (Nt)	Lets suppose t=1
Time complexity	f for recursion:
@ Linear	Davide &
	Dowide & Conquern
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	Search
F(N)=F(N-1)+	F(N)=f(N)+0(1)
F(N-2)	
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Divide & Conquery Hectiverence:

How to identity?

Form

T(n)= Q, T(b, n + E(n)) +

Q2 T (b2 n + E(n)) + ... +

Qnx T (bx n + Ex (n) +

g(n)

for n ≥ no

Akra-Bayze theorem

n

 $T(n) = \theta \left(n^{p} + n \right) \left(n - \frac{g(n)}{n^{p+1}} \right)$

 $P \rightarrow P$ buch that $a_1b_1' + a_2b_2'' + \cdots = 1$ $E = a_1b_1'' = 1$ i = 1

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Birnary Search

Enamble:

Merge sort

$$T(N) = 2T\left(\frac{N}{2}\right) + (N-1)$$

$$q_1 = 2$$
, $b_1 = \frac{1}{2}$, $g(n) = N-1$

by using 1

$$2 * \left(\frac{|A|}{2}\right)^{P} = 1$$

Date (u-1) dr 0 (n+ x dy -0 (n+n And the ntn I dog u -Later Park log n The same O(n+nlogn+1 E O (n logn + 1) rignored E) // Time Complexity The state of the s 0 (n log n E www.yodlee.com The same

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For array of size N:

Merger complenity = 0 (Nlogn)

guestion.

$$T(N) = 2T(\frac{N}{2}) + \frac{8}{9} \cdot T(\frac{3N}{4}) + N^{2}$$

$$q_{1} \qquad b_{1} \qquad q_{2} \qquad b_{2}$$

$$2 \times \left(\frac{1}{2}\right)^{p} + \frac{2}{9} \left(\frac{3}{4}\right)^{p} = 1$$

$$T(n) = \theta \left(n^2 + n^2 \right) \frac{u^2}{n^{2+1}} du$$

$$= \theta \left(n^2 + n^2 \right) \frac{u^2}{u^3} du$$

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 $O(n^2 + n^2) \int \frac{u^2}{u^3} du$ Z+n² logn O (n² logn u can't find value of P $\frac{n}{3}$ + $\frac{4}{4}$ $\frac{7}{4}$ $\frac{n^{2}}{4}$ Let's try P=1 we are getting increase dens

www.yodlee.com P > 1

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P = 2

$$=\frac{1}{3}+\frac{1}{4}=\frac{4+3}{12}=\frac{7}{12}$$

1>P<2

Hence
$$g(n) = n^2$$

 $P(2)$ (i.e. Power of $g(n)$)

$$T(n) = 9 \left(n^{p} + n^{p}\right) \frac{y^{2}}{y^{p+1}} dn$$

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Date . 0 (np+n2 0(22) Solving Linear Recurrence Example: (N) = F(N-1) + F(N-2)www.yodlee.com