

```

int noName (int n, int target, int limit)
{
    int * ptr = null ptr;
    for (int i=0; i<n; i++) {
        ptr = new int (rand() % limit);
        if (*ptr == target)
            return i;
    }
    return -1;
}

```

Worst : target is not found during

the for loop  $\Rightarrow$  time complex =  $O(n)$

Best : target is found in the first

iteration  $\Rightarrow$  time complex =  $\Omega(1)$   
constant

$n = 5$  target 3 limit 2

ptr  $\rightarrow$

i	n	ptr	*ptr
<del>0</del>	5	<del>1080</del>	5
<del>1</del>		1010	10
<del>2</del>		<del>20</del>	20
<del>3</del>		800	80
<del>4</del>		220	22
5			

n iteration

a. for ( cnt4 = 0; i = 1; i <= n; i \* = 2 )

for ( j = 1; j <= i; j ++ )

cnt4 ++ ;

---

b. for ( cnt2 = 0; i = 1; i <= n; i ++ )

for ( j = 1; j <= i; j ++ )

cnt2 ++ ;

---

c. for ( cnt3 = 0; i = 1; i <= n; i \* = 2 )

for ( j = 1; j <= n; j ++ )

cnt3 ++ ;

---

$n=10 \rightarrow$	$i$	$n$	$j$	cut4				
5	<del>1</del>	10	①	$2^0$	<del>1</del>	2	0	
1 2 4			2	<del>1</del>			1	
$\log_2 5 = 2$	2		①	$2^1$	2	2	1	
			<del>2</del>		3			
$\log_2 10 = 3 \dots$			3				2	
$i \log_2 10$			①		4	2		
$\log_2 n \cdot \log_2 8$			2		5			
$(\log_2 n)^2$			3		6			
			①	$2^3$	7			
			2		8			
			3		9			
			4		10			
			5		11			
			6		12			
			7		13			
			8		14			
			9		15			
			10		16			

$1 + 2 + 4 + \dots + 2n$   
 $= 2n$   
 $O(n)$

$\log n < n$

outer loop  $\rightarrow \log_2 n = O(\log_2 n)$

inner loop  $\rightarrow$

$2^0$   
 $2^1$   
 $2^2$   
 $2^3$   
 $\vdots$

$$2^0 + 2^1 + \dots + 2^{\log_2 n}$$

b/

n	i	j	cnt
5	1	1	0
		2	1
	2	1	2
		2	3
		3	
3	1	1	4
	2	1	5
	3	1	6
	4	1	
4	1	1	7
	2	1	8
	3	1	9
	4	1	10
	5	1	
5	1	1	11
	2	1	12
	3	1	13
	4	1	14
	5	1	15

outer loop  $\rightarrow n$

inner loop  $\rightarrow i$

Dominant factor  
is the nested loop

$$1 + 2 + 3 + 4 + \dots + n$$

$O(n^2)$

$$\frac{n}{2} (a_1 + a_n) = \frac{n}{2} (1 + n)$$

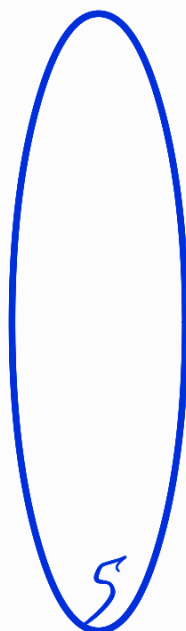
$$\frac{n}{2} + \frac{n^2}{2}$$

$\uparrow$   
 $n^2$

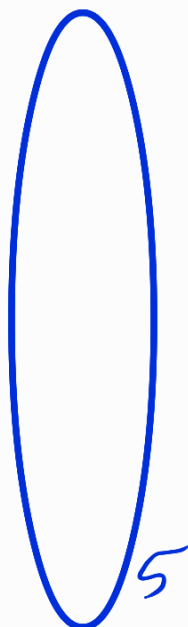
9/

n	i	j	ans
5	<del>1</del>	<del>1</del>	<del>0</del>
		2	1
		3	3
		4	4
		5	5

2



3



after loop  $\rightarrow \log_2 n$

inner loop  $\rightarrow n$

$n \log_2 n$

$O(n \log(n))$

$$f(n) = \log n \rightarrow \log(10^3)^{100000} = 100000 \underbrace{\log 1000}_{10} \\ = 10^6$$

$$\xrightarrow{1 \text{ hr}} 10^6 \times 3600$$

$$\xrightarrow{1 \text{ month}} 10^6 \times 2592 \times 10^3 = 2592 \times 10^9$$

$$\xrightarrow{1 \text{ century}} 10^6 \times 31536 \times 10^5 = 31536 \times 10^{11}$$

$$f(n) = n$$

$$\xrightarrow{1 \text{ sec}} \sqrt{10^{300000}} = \text{infinity } \infty$$

$$\xrightarrow{1 \text{ hr}} \infty \cdot 3600 = \infty$$

$$\xrightarrow{1 \text{ month}} \infty \cdot 2592000 = \infty$$

$$\xrightarrow{1 \text{ century}} \infty \cdot 315360000 = \infty$$



$$f(n) = n \log(n)$$

$$\begin{array}{l} \xrightarrow{1 \text{ sec}} 10^{300000} \log 10^{300000} = 10^{300000} \times 6 \times 10^{300000} \\ \quad \quad \quad \underbrace{\log 10}_{10^6} \end{array}$$

$$\xrightarrow{1 \text{ hour}} 3600 \times 10^{300006}$$

$$\xrightarrow{1 \text{ month}} 2592000 \times 10^{300006}$$

$$\xrightarrow{1 \text{ century}} 3153600000 \times 10^{300006}$$

$$Len = n^2$$

$$\xrightarrow{1 \text{ sec}} (10^{300000})^2$$

$$\xrightarrow{1 \text{ hour}} 3600 \times (10^{30000})^2$$

$$\xrightarrow{1 \text{ month}} 2592000 \times (10^{3000})^2$$

$$\xrightarrow{1 \text{ Century}} 3153600000 \times (10^{3000})^2$$

$$f(n) = n^3$$

$$\xrightarrow{1 \text{ sec}} (10^{300000})^3$$

$$\xrightarrow{1 \text{ hour}} 3600 \times (10^{30000})^3$$

$$\xrightarrow{1 \text{ month}} 2592000 \times (10^{3000})^3$$

$$\xrightarrow{1 \text{ Century}} 3153600000 \times (10^{3000})^3$$

$$f(n) = 2^n$$

$$\xrightarrow{1 \text{ sec}} 2^{3000000}$$

$$\xrightarrow{1 \text{ hour}} 3600 \times 2^{3000000}$$

$$\xrightarrow{1 \text{ month}} 2592000 \times 2^{3000000}$$

$$\xrightarrow{1 \text{ century}} 315360000 \times 2^{3000000}$$

