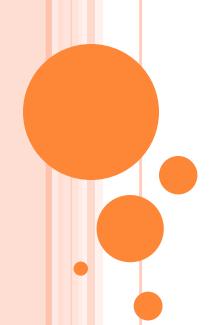




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Time Complexity Examples: O(n)

```
for (i=0; i<n; i++) {
    statements...
}
```

```
for (i=0; i<n; i=i+2) {
    statements...
}
```

```
for (i=0; i<n; i=i+50) {
    statements...
}</pre>
```

```
def factorial( n ):
    if n == 1:
        return 1
    return n * factorial( n - 1 )
```

$$\begin{cases} \alpha_{l}=1\\ \alpha_{n-1} \end{cases}$$



Time Complexity Examples: $O(n^{1/2})$

```
p=0;
for (i=0; p<n; i++) {
    p=p+i;
}</pre>
```

```
\begin{array}{cccc}
 & \rho & 0 & 0 \\
 & 1 & 0+1 \\
 & 2 & 0+1+2 \\
 & 3 & 0+1+2+3
\end{array}

\begin{array}{ccccc}
 & k = k(k+1)/2 = n \\
 & k = O(n^1/2)
\end{array}
```

```
i=1;
k=1;
while (k<n) {
    statements...
    k=k+i;
    i++;
}</pre>
```



Time Complexity Examples: O(n²)

```
for (i=0; i<n; i++) {
    for (j=0; j<n; j++) {
        statements...
    }
}
```

互相獨立

```
for (i=0; i<n; i++) {
    for (j=0; j<i; j++) {
        statements...
    }
}
```

depand on i 0+1+2+3... n(n+1)/2 = O(n^2)



Time Complexity Examples: O(log(log(n)))

```
p=0;
for (i=0; i<n; i=i*2) {
     p++
                                     3 1*2*2 3
                                     k 2^{(k-1)}
for (j=0; j<p; j=j*2) {
                                     k-1 = logn
     statements....
                                     k = logn
                                  O(log(p)) =>
                                  O(lon(logn))
for (i=0; i<n; i=i*2) {
     statements...
                                        n
                                        n/2
                                        n/2^2
                                        n/2^k
for (i=n; i>=1; i=i/2) {
     statements...
```



Time Complexity Examples: O(log(log(n)))



Time Complexity Examples: O(n log(n))

```
for (i=0; i<n; i++) {
    for (j=1; j<n; j=j*2) {
        statements...
    }
}</pre>
```

```
for (i=1; i<n; i++) {
    for (j=1; j<n; j=j+i) {
        statements...
    }
}</pre>
```

```
\int_{1}^{n} \frac{1}{x} dx = \ln(n)
```

```
i j
1 1
2 1*2
3 1*2*2
2^(k-1) =n
k-1 = log2(n)
加上外迴圈 O(nlogn)
```

```
i j

1 n

2 n/2

3 n/3

k n/k

n+n/2+n/3+...n/k ...n/n

= n(1+1/2+1/3...)

nlogn
```



Time Complexity Examples: O(2ⁿ)

```
int fibo(n){
  if (n==1) return 1;
  if (n==2) return 2;
  return fibo(n-1)+fibo(n-2);
}
```



References

References

- Time Complexity #1
- Time Complexity #2
- How to find time complexity of an algorithm