算法设计与分析 Assignment 1

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A	B	O	o	Ω	ω	Θ
$lg^k n$	n^ϵ	NO	NO	YES	YES	NO
n^k	c^n	NO	NO	YES	YES	NO
$\sqrt{n}$	$n^{\sin n}$	NO	NO	NO	NO	NO
2^n	$2^{n/2}$	YES	YES	NO	NO	YES
$n^{\lg c}$	$c^{\lg n}$	YES	NO	YES	NO	YES
$\lg(n!)$	$\lg(n^n)$	YES	NO	YES	NO	YES

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Each line represents an equivalent class, and the growth rate increases as the line goes down.

$$n^{1/\lg n}$$
$$1$$
$$lg(lg^* n), lg^* lg(n)$$
$$\ln \ln n$$
$$lg^2(n)$$
$$lg^* n, \ln n$$
$$\lg^2 n$$
$$n$$
$$nlgn$$
$$n^2$$
$$n^3$$
$$2^{\sqrt{2lgn}}$$
$$\sqrt{2}^{\lg n}, 2^{\lg n}, 2^{lg^* n}$$
$$4^{\lg n}$$
$$(\lg n)!$$
$$(\lg n)^{\lg n}, n^{\lg \lg n}$$
$$\left(\frac{2}{3}\right)^n$$
$$2^n$$
$$n \cdot 2^n$$
$$e^n$$
$$n!$$
$$(n+1)!$$
$$2^{2^n}$$
$$2^{2^{n+1}}$$

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a. False. Because if $\log n = O(n^2)$, but $n^2 \neq O(\log n)$.

b. False. Because $n^2 + n = \Theta(n^2) \neq \Theta(min(n, n^2))$

c. True.

Because $f(n) = O(g(n))$ then $\exists c, n_0.\ f(n_0) \leq cg(n)$

So $\lg(f(n_0)) \leq \lg(cg(n)) = \lg c + \lg g(n)$

So $\lg f(n) = O(\lg(g(n)))$.

d. False.

Because $f(n) = O(g(n))$ then $\exists c, n_0.\ f(n_0) \leq cg(n_0)$

So $2^{f(n_0)} \leq 2^{cg(n_0)}$

So $2^{f(n_0)} = O(2^{cg(n_0)})$, in which case $c > 0$, so $O(2^{cg(n_0)}) \neq O(2^{g(n_0)})$

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The pseudocode is as follows:

```
SELECTION-SORT-REVERSE(A, n)

current_pos := n - 1
while current_pos >= 0
    greatest_pos = 0
    current_greatest = 0
    for i := 0 to current_pos:
        if A[i] > current_greatest
            current_greatest := A[i]
    EXCHANGE_ELEMENT(greatest_pos, n - 1)
    current_pos := current_pos - 1
```

Loop invariant: The array[current_pos, n-1] is always a sorted array.

Bestcase: $\Theta(n^2)$

Worstcase: $\Theta(n^2)$