



Analysis Practice

Using the definition of $O(n)$, show that $27n^3 + 12n^2 + 25000 \in O(n^3)$

Next, a more general result: $an^2 + bn + d \in O(n^2)$ for positive constants a, b, d .

Using the definition of $\Omega(n)$, show that $15n^2 + 37 \in \Omega(n)$.

This is a fairly tricky one from the text that we can work through.
Use the definition of $\Theta(n)$ to show that $\frac{1}{2}n(n - 1) \in \Theta(n^2)$.

A more straightforward example is to use the definition of $\Theta(n)$ to show that $7n^3 - 4n + 17 \in \Theta(n^3)$

Using limits, let's compare the following functions' growth rates.

$$f(n) = 20n^2 + n + 4 \text{ and } g(n) = n^3.$$

$$f(n) = n^2 \text{ and } g(n) = n^2 - n.$$

$$f(n) = 2^{\log n} \text{ and } g(n) = n^2.$$

$$f(n) = \log(n^3) \text{ and } g(n) = \log(n^4).$$

$$f(n) = \log_2(n) \text{ and } g(n) = n.$$

ALGORITHM MAXELEMENT(A)

//Input: an array $A[0..n - 1]$

$maxval \leftarrow A[0]$

for $i \leftarrow 1..n - 1$ **do**

if $A[i] > maxval$ **then**

$maxval \leftarrow A[i]$

return $maxval$

Input size parameter:

Basic operation:

Best/average/worst cases:

Computing the number of comparisons, $C(n)$

$C(n) =$

ALGORITHM UNIQUEELEMENTS(A)

//Input: an array $A[0..n - 1]$

for $i \leftarrow 0..n - 2$ **do**

for $j \leftarrow i + 1..n - 1$ **do**

if $A[i] = A[j]$ **then**

return *false*

return *true*

Input size parameter:

Basic operation:

Best/average/worst cases:

Computing the number of comparisons, $C(n)$

ALGORITHM MATRIXMULTIPLY(A, B)//Input: an array $A[0..n-1][0..n-1]$ //Input: an array $B[0..n-1][0..n-1]$ **for** $i \leftarrow 0..n-1$ **do** **for** $j \leftarrow 0..n-1$ **do** $C[i][j] \leftarrow 0$ **for** $k \leftarrow 0..n-1$ **do** $C[i][j] \leftarrow C[i][j] + A[i][k] * B[k][j]$ **return** C

Input size parameter:

Basic operation:

Best/average/worst cases:

Computing the number of multiplications, $M(n)$ $M(n) =$