SIENAcollege
Computer Science

Computer Science 385
Design and Analysis of Algorithms
Siena College
Spring 2025

Analysis Practice

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.

Show that $15n^2 + 37 \in \Omega(n)$.

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

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

Using limits, let's compare the following functions' growth rates.
$f(n) = 20n^2 + n + 4$ and $g(n) = n^3$.

$f(n) = n^2$ and $g(n) = n^2 - n$.

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

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

$f(n) = \log_2(n)$ 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, $M(n)$

$M(n) =$