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ECGR3180 - Assignment 2

3. **(12 pts)** Programs A and B are analyzed and found to have worst-case running times no greater than $150\mathrm{Nlog_2N}$ and N^2, respectively. Answer the following questions:
   a) Which program has the better guarantee on the running time for large values of N (N > 10,000)?
   b) Which program has the better guarantee on the running time for small values of N (N < 100)?
   c) Which program will run faster on average for N = 1000?

a)
Programs A will have better run time, where we can plug in a number that's is larger then 10,000.

b)
Programs A will theoretically have better guarantee on run time, but when the values is so small Additionally with multiplication of 150, that both programs' run time will be very close to the same.

c)
When there is a specific value set to N, there are no such necessary to use big O to calculate run time speed of any programs.

4. **(8 pts)** Solve the following recurrence relations using the Master theorem.
   a) $T(n) = 3T(\frac{n}{3}) + \frac{n}{2}$
   b) $T(n) = 4T(\frac{n}{2}) + n^{2.5}$

Master theorem form of $T(n) = aT(\frac{n}{b}) + f(n)$

a) compare $n^{\log_b a}$ with $f(n)$

$a = 3,\ b = 3.$

$d = \log_b a = \log_3 3 = 1$

$n^{\log_b a} = n^{\log_3 3} = n$

Same as $f(n) = O(n)$

$O(n \log n)$

b) $a = 4,\ b = 2$

$n^{\log_b a} = n^{\log_2 4} = n^2$

$n^2 < f(n) = n^{2.5}$

$O(n^{2.5})$