CS 381 PSO #3

Week 4

Master Theorem Practice

1. $T(n) = 3T(n/2) + n^2$
2. $T(n) = 7T(n/2) + n^2$
3. $T(n) = 4T(n/2) + n^2$
4. $T(n) = 4T(n/2) + \log(n)$
5. $T(n) = T(n - 1) + n$
6. $T(n) = 2T(n/4) + n^{(0.51)}$
7. $T(n) = 2T(n/4) + \sqrt{n}$
8. $T(n) = 7T(n/3) + n^2$
9. $T(n) = 16T(n/4) + n$

Induction/Proof Practice Slide 1

Oh no! A new mathematical monopoly has placed a massive tax on all uses of the multiplication and division operations. However, this has not excused your responsibilities in finishing your CS 381 homework. Luckily, your homework this time is relatively simple: compute the square of an integer n. Of course, being an algorithms course and not a math course, they ask you to write a recursive algorithm to complete the task using only bitshifting, addition, and subtraction.

Reminder: Bitshifting

Induction/Proof Practice Slide 2

This is the algorithm that you and your collaborators came up with: If n is even, then we know that $n^2 = (n >> 1)^2 << 2$, and if n is odd, then we know that $n^2 = ((n-1) + 1)^2 = (((n-1)>>1)^2) << 2) + 1 + ((n - 1) << 1)$. Thus, by recursively calling these two relationships on n, we may evaluate n^2 by proceeding until the number we give to the relationship has absolute value less than 2, in which case those numbers squared are equal to themselves so there is no longer a need to calculate.

Example: $n = 4$

More induction!

Given DeMorgan's Law for 2 sets, prove the generalized version for n sets

$$\text{Given: } \overline{A \cap B} = \overline{A} \cup \overline{B}$$

$$\text{Prove: } \overline{A \cap B \cap \ldots} = \overline{A} \cup \overline{B} \cup \ldots$$