CS200 Fall 2014 WA2 due 10/7/14 by 9:30AM

Put both your name and your lab section at the top of your submission.

1. [15 points] Use mathematical induction to show that whenever n is a positive integer:
$$\frac{1}{1*3}+\frac{1}{3*5}+\cdots+\frac{1}{(2n-1)(2n+1)}=\frac{n}{2n+1}$$
   a) What is the basis step?
   b) What is the inductive step?
2. [20 points] Give a big-O estimate for each of these functions. For the function g in your estimate $f(x)$ is $O(g)$, use a simple function g of smallest order.
   a. $6x^4+3^x+12$
   b. $2+4x+8x^2$
   c. $(x^3+2x)/(2x+1)$
   d. $\log x+27$
   e. $(2^x+x^2)(x^4+3^x)$
3. [12 points] In the manner of Examples 1 and 2 from section 3.2 of the Rosen text, show that $4x^3+12x+8$ is $O(x^4)$. Give an explanation and values of C and k.
4. [15 points] For the following equation: $32x^4+((5x^2+x)(13x^3+1))$
   a. State the closest $g(x)$ for the equation.
   b. Explain how the Big-O is computed given Theorems 1, 2 and 3 in Section 3.2 in Rosen.
5. [20 points] Assuming you use k=1 as a witness, state whether the following functions are $O(x^3)$, and if so, state for what value of C.
   a. 3^x
   b. $10x+42$
   c. $2+4x+8x^2$
   d. $(\log x+1)(2x+3)$
   e. $2x+x!$
6. [18 points] Given the following algorithm, what is its Big-O? Justify your answer using the three theorems presented in the Complexity notes (and found in section 3.2 of Rosen). Assume the line "d" takes O(1) or O(c).

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a. for (int x = 1; x <= n; ++x) {
b.     for (int y = 0; y < n; ++y) {
c.         for (int z = n; z > n-10; --z) {
d.             m = m * aArray[x] * bArray[y] * cArray[z];
e.         }
f.     }
g. }
```