STAT 598Z: Homework 2

Due: 14th February 2012

1. This homework will contribute 10 points towards your final score.
2. Attempt as many problems as possible.
3. Only neatly handwritten solutions will be accepted. Alternatively you may use LaTeX to typeset your solutions.
4. Hand in your HW (including print outs of your source code) at the beginning of the class on 31st January 2012. Additionally source code (if any) should be emailed to `stat598z@gmail.com` **before** the assignments are submitted in the class. No late submissions will be accepted!
5. Program files should be named after the problem (e.g. solution to problem 1 should be problem1.py etc).

Problem 1 (2 pt) Write a Python program which

- Creates a list `x` which contains the numbers $(2, 3, 4, 5, 6, 7, 8)$
- Use simple Python statements to transform it into a list which contains $(2, 3, 4, 5, 12, 6, 7, 8)$. In other words, insert 12 into the list.
- Give at least two different ways to transform the list into $(2, 3, 4, 5, 12, 7, 8)$. In other words, give two different ways to exclude an element out of a list.
- Now transform `x` into the vector $(2, 3, 4, 5, 12, 7, 8, 9)$ using the append command.
- Finally, replace the element 4 in `x` by 32 by a single command. In other words, transform `x` into $(2, 3, 32, 5, 12, 7, 8, 9)$.

Problem 2 (2 pt) Write a Python program which takes as input an integer `n` and computes $\sum_i^n i$ and $\sum_i^n i^2$ using a `for` loop. Use an analytic formula to compute the two sums and verify the result produced by your `for` loop. Test and report what happens when `n` is very large (e.g. 100,000 or larger).

Problem 3 (3 pt) Show that

- x^2 is $o(x^3)$
- $x \log x$ is $o(x^2)$
- x^2 is $o(2^x)$

- $x^2 + x + 1$ is not $o(x^2)$

Hint: Use limits for all cases and L'Hospital's Rule wherever needed.

Problem 4 (3 pt) Devise a recursive algorithm for finding the sum of the first n positive integers. State the recurrence, draw the recursion tree, and find the complexity of your algorithm with respect to n in Θ notation.