STAT 598Z: Homework 2

Due: 12th February 2013

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 12th February 2013. 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 does the following in sequence:

- Creates a list `x` which contains the numbers $[9, 10, 11, 12, 13, 14, 15, 16]$.
- Prints the last three elements of `x`.
- Prints out all the even numbers in `x`.
- Deletes all the even numbers from `x` and prints the resulting list.
- **Bonus (no points):** Create a tuple `y` from `x`. What happens when you try to insert or delete elements from `y`?

Problem 2 (2 pt) Write a Python program which takes as input an integer `n` and computes $\sum_i^n (1/2)^i$ in three ways: using a `for` loop, using a `while` loop, and without using a loop (e.g., by using an analytic formula). Print out all three results. What happens when `n` is very large? Do you have any suggestions on how to make your program more robust to errors when `n` is large?

Problem 3 (3 pt) Show that

- x^3 is $O(x^3)$ and $\Theta(x^3)$ but not $\Theta(x^4)$
- For any real constants a and $b > 0$, we have
$$(n + a)^b = \Theta(n^b).$$
- $(\log(n))^k = O(n)$ for any k

- $n/(n+1) = 1 + O(1/n)$
- $\sum_{i=0}^{\lceil \log_2(n) \rceil} 2^i$ is $\Theta(n)$

Problem 4 (3 pt) Consider the following function in python:

```
def mystery(x, n):
    if n==0:
        return 1.0
    if (n % 2):
        return mystery(x,n-1)*x
    else:
        tmp=mystery(x,n/2)
        return tmp*tmp
```

where `x` is a float and `n` is a non-negative integer.

- What is this function computing?
- Draw the recursion tree for this algorithm and compute its complexity with respect to n in O (or if applicable in Θ) notation.