COMP 4030/6030 Spring 2018. Assignment 3
Due: Feb 20, 2018 (before class starts)

Assignment:
1. (20 points) Use the definition of O to prove that $5n^3 + 10n^2 + 1$ is in $O(n^4)$
2. (20 points) Use the definition of Ω to prove that $5n^3 + 10n^2 + 1$ is in $\Omega(n^3)$
3. (20 points) Use the geometric sum to find the answer for $1 + 6 + 6^2 + 6^3 + \ldots + 6^{31}$.
4. (10 points) Use repeated substitution to find the running time of $T(n) = 4n + T(n-1)$. Assume $T(1) = 1$.
5. (10 points) Use repeated substitution to find the running time of $T(n) = 4n + T(n/2)$. Assume $T(1) = 1$. If you can do problem 3 and know how to use substitution, you should be able to do this problem.

6. (20 points) Write a **recursive** Python function that takes as input two sorted lists of numbers and returns a sorted union of the two input lists. For example, **union**([1,5,10,20], [2,4,10]) returns [1,2,4,5,10,10,20].

   The function should look like this:

   # Input: A and B are both sorted lists
   # Output: C is sorted and is a union of A and B.
   def union(A, B):
       # your code goes here
       # …

       return C

   The following observations can be helpful:
   - Problem size is len(A) + len(B)
   - Compare the first elements of A and B.
   - Suppose A[0] < B[0]. Then, you can remove A[0] and know that it is the first element of the union.
   - How do you the same problem with problem size len(A) + len(B) - 1? Answer: use the same strategy.
   - Do not trace function calls. Instead abstract the same strategy as a recursive call.
   - Of course, you will need to take care of "smallest" cases, where you can't remove the first element of A or B.

Plagiarism Policy:

You can discuss how to solve the problems with your classmates, but the solution must be your own. Using other people's solution will result in a zero for the assignment and possible additional penalties.

Submission:
Put Python code in one Python (.py) file. Put other work in a separate text file.

Put your name as part of the file name. For example: If your name is John Smith, name your files like this: **JohnSmith_hw3.py** and **JohnSmith_hw3.txt** (or **JohnSmith_hw3.docx**).

Upload your submission to the Assignment 3 folder in the eCourseware Dropbox.