CSE 3500: Problem Set 1
Due by 11:59 PM on Monday, Sept 11.

Please note:

- *Students are permitted to discuss general concepts and questions concerning the homework assignments, but sharing written solutions with others or using solutions provided by others, in part or in whole, is prohibited.*
- *Whenever a question asks you to give an algorithm for a problem, be sure to also prove its correctness and analyze its time complexity.*
- *If you consult an outside resource (e.g., web page, book, or research paper) to arrive at your solution, be sure to cite that resource.*

Suggested reading: Chapter 2 from textbook.

Homework questions:

Question 1. (10 points) Consider the following simple algorithm for sorting an input array $A[1 \ldots n]$ of n numbers. The algorithm first finds the smallest element of A and exchanges it with the element in $A[1]$. Then it finds the second-smallest element of A and exchanges it with $A[2]$. The algorithm continues in this manner for the first $n-1$ elements of A (i.e., continues for $n-1$ iterations).
(i) Provide pseudocode for this algorithm. You do not need to prove correctness of this algorithm.
(ii) Give the worst case running time for this algorithm in Θ notation and justify your answer.

Question 2. (10 points) Suppose we want to compute the value x^y, where x and y are positive integers with m and n bits, respectively. One way to solve the problem is to perform $y-1$ multiplications by x. Can you give a more efficient algorithm that uses only $O(n)$ multiplication steps?

Question 3. (10 points) Given a positive real number c, show that the function $g(n) = 1 + c + c^2 + \ldots + c^n$ is (i) $\Theta(1)$ if $c < 1$, (ii) $\Theta(n)$ if $c = 1$, and (iii) $\Theta(c^n)$ if $c > 1$.

Question 4. (10 points) Exercise 6 from Chapter 2, pages 68-69 of the textbook.