CSE 5050 Algorithms and Complexity
Problem Set 2.1

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.*

Required preparation: Video lectures M2_L1, M2_L2, M2_L3, and M2_L4.

Suggested reading: Chapter 2 from textbook.

Homework questions:

Question 1. (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 2. (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 3. (10 points) Exercise 6 from Chapter 2, pages 68-69 of the textbook.