CSCI B505 – Fall 2018

Written Assignment 3:

Due online Oct. 8 (MON), 2018, 11:59pm EST.

You can use LaTeX, Word, or even pen and paper to write down your answers. But **please try to submit a PDF file.**

1. Binomial Coefficients. A binomial coefficient $C(n, k)$ can be defined as the coefficient of X^k in the expansion of $(1 + X)^n$.
   Describe and prove an algorithm that takes two parameters n and k and returns the value of $C(n, k)$.

2. Paving road. You have a road that is n meters long, and you also have stones that are $2, 3, 5$ meters long respectively. Write an algorithm that counts the number of ways in which the road can be paved by these kinds of stones.

3. Given a set of n elements, write an algorithm that finds number of ways of partitioning it.
   Example: When $n = 2$, there are 2 ways of partitioning the set(into two sets with one element, or into the original set and the empty set).

4. Grid pathway problem. Given a grid of size $n \times m$, find an algorithm that calculates the number of shortest pathways that starts from the bottom-left vertex and ends at the top-right vertex.
   Example: For a 1×1 grid, there are two shortest pathways of length 2 from the bottom-left vertex to the top-right vertex.