CS3230: Assignment for Week 6

Due: Sunday, 27th Feb 2022, 11:59 pm SGT.

Please upload PDFs containing your solutions (hand-written & scanned, or typed) by 27th Feb, 11:59 pm to `Assignments/Assignment6/Submissions`. Name the file **Assignment6_SID.pdf**, where SID should be replaced by your student ID.

You may discuss the problems with your classmates or read material online, but you should write up your solutions on your own. Please note the names of your collaborators or online sources in your submission; failure to do so would be considered plagiarism.

1. (1 point) In string matching, suppose that all characters in the pattern P are different. Show how to accelerate the naive string-matching algorithm to run in time $O(n)$, where n denotes the length of the text T.

2. (1 point) Design and analyze an algorithm that, given three arrays A, B, C, each containing n integers, decides whether there exist elements $a \in A, b \in B, c \in C$ such that $a + b - c = 2022$. The algorithm should run in expected time $O(n^2)$. (Assume that arithmetic operations and hash functions on the array elements can be performed in constant time.)

3. (1 point) Suppose that you receive a stream of numbers. Upon receiving the first number x_1, you set a random variable X to be x_1. For $k \geq 2$, upon receiving the k-th number x_k, you set $X = x_k$ with probability $1/k$, and keep X unchanged with the remaining probability $1 - 1/k$. Prove that, at every stage, X is uniformly sampled from the numbers that you have seen.