CSE 411: Complexity and Advanced Algorithms
Monsoon 2018
IIIT Hyderabad

Homework 5, Due: November 5, 2018

Each problem is for 10 points.

Problem 1. Consider the setting of balls and bins where n balls are thrown uniformly at random into n bins. Answer the following questions.

- What is the expected number of empty bins?

- What is the probability that some bin has more than $6 \log n$ balls. Use Chernoff bounds and not a direct calculation using binomials.

Problem 2. Consider the sum X of n identically distributed and independent geometric random variables $X_1, X_2, \cdots, X_n$. Let p be the probability that each such X_i takes the value 1. Answer the following questions.

- WHat is $E[X_1]$.

- What is $E[X]$.

- Find a suitable Chernoff bound for the tail of X.

Problem 3. To go to an event you are required to collect one sticker of n different types. These stickers are given out uniformly at random by the dealer. You can approach the dealer any number of times till you get at leats one sticker of each type. Find the expected number of times you have to visit the dealer that you get at least one sticker of each type.