Problem Set 5

CSCE 658 Randomized Algorithms

Due dates: Electronic submission of the .pdf file of this homework is due on **3/19/2019 before 2:00pm** on e-campus (as a turnitin assignment), a signed paper copy of the pdf file is due on **3/19/2019** at the beginning of class.

Name: (put your name here)

Resources. (All people, books, articles, web pages, etc. that have been consulted when producing your answers to this homework)

On my honor, as an Aggie, I have neither given nor received any unauthorized aid on any portion of the academic work included in this assignment. Furthermore, I have disclosed all resources (people, books, web sites, etc.) that have been used to prepare this homework.

Signature: _____

Problem 1. Let X be the sum of n independent $\{0,1\}$-valued random variables with $\mu = \mathrm{E}[X]$. One can deduce from the Chernoff bound

$$\Pr[X \geq (1+\delta)\mu] \leq \left(\frac{e^{\delta}}{(1+\delta)^{1+\delta}}\right)^{\mu}$$

the convenient version: For all real numbers $r \geq 2e\mu$, we have

$$\Pr[X \geq r] \leq 2^{-r}.$$

Find your own proof of this bound.

Solution.

Problem 2. Consider the following modification to the bit-fixing routing algorithm for routing a permutation on the n-dimensional hypercube. Suppose that, instead of fixing the bits in order from 1 to n, each packet chooses a random order (independent of other packets' choices) and fixes the bits in that order. Show that there is a permutation for which this algorithm requires $2^{\Omega(n)}$ steps with high probability.

Solution.

Problem 3. Find a paper on randomized algorithms, randomized protocols, or randomized data structures in one of the RANDOM/APPROX, STOC, FOCS, SODA or similar conferences and write a 1-2 page review that highlights the main idea of the paper and one of the main techniques that is used in the paper.

Solution.

Checklist:

- ☐ Did you add your name?
- ☐ Did you disclose all resources that you have used?
  (This includes all people, books, websites, etc. that you have consulted)
- ☐ Did you sign that you followed the Aggie honor code?
- ☐ Did you solve all problems?
- ☐ Did you submit the pdf file (resulting from your latex file) of your homework?
- ☐ Did you submit a hardcopy of the pdf file in class?