

Homework of Week 3

Deadline: 9:00am, November 10 (Sunday), 2019

1. Let X_1, \dots, X_n be independent random variables on $[0, 1]$. let $X = \sum_{i=1}^n X_i$ and $\mu = \mathbb{E}[X]$. Then the following Chernoff bound holds: for any $\delta > 0$, $\Pr(X \geq (1 + \delta)\mu) \leq (\frac{e^\delta}{(1+\delta)^{(1+\delta)}})^\mu$. Also prove a similar bound for the probability $\Pr(X \leq (1 - \delta)\mu)$ for any $0 < \delta < 1$. (Hint: use $e^{\lambda x} \leq xe^\lambda + (1 - x)$)
2. The set balancing problem aims at dividing the data into two groups that are balanced in every feature. If the objective is not balanced but 1:2 in every feature, the vector b should be chosen from $\{-1, 2\}^m$. Please adapt the algorithm and analyze the performance.
3. Do Bernoulli experiment for 20 trials, using a new 1-Yuan coin. Record the result in a string $s_1 s_2 \dots s_i \dots s_{20}$, where s_i is 1 if the i^{th} trial gets Head, and otherwise is 0.