Homework 9
MATH 165 - Fall 2020
Tufts University, Department of Mathematics
Due: November 12, 2020

1. Book Questions

Grinstead and Snell: Section 8.1 #3 #11, 8.2 #1, #2, #17

2. Supplemental Question (Hoeffding versus Chebyshev)

A different concentration inequality than the ones we consider is *Hoeffding's Inequality*. It has many forms, but one version is as follows.

Theorem. *(Hoeffding) Let* $\{X_n\}_{n=1}^N$ *be a sequence of i.i.d. random variables that take values in* $[0,1]$*. Let* $Y = \frac{1}{N}\sum_{n=1}^{N} X_n$ *be the average of these random variables. Then* $\mathbb{P}(|Y - \mathbb{E}(Y)| \geq \epsilon) \leq 2\exp(-2N\epsilon^2)$.

(a) Compare Hoeffding's inequality to Chebyshev's inequality. How do they differ? Which one is more flexible? Which one has a more powerful conclusion?

(b) Let each X_n be uniform on $[0,1]$. Compare the estimates of $\mathbb{P}(|Y - \mathbb{E}(Y)| \geq \epsilon)$ yielded by Chebychev and Hoeffding, as a function of N. Which is more powerful?