EE5603: Concentration Inequalities, Spring 2022 (12)

Indian Institute of Technology Hyderabad

HW 1, 25 points. Assigned: Thursday 01.09.2022.

Due: Sunday 04.09.2022 at 11:59 pm.

1. The $\chi^2(n)$ random variable is defined as $\chi^2(n) = \sum_{i=1}^{n} X_i^2$ where X_i are independent standard normal random variables. Empirically check for sub-Gaussianity of $\chi^2(n)$ as a function of n. (5)
2. Demonstrate the following with a Python script:
   (a) Sub-Gaussianity of a Uniform random variable with range $[-a, a]$. (5)
   (b) Non sub-Gaussianity of a Laplacian random variable with zero mean and variance $2b^2$. (5)

   Choose the variance of the "reference" Gaussian appropriately.
3. Empirically compare (using a Python script) the sharpness/tightness of the tail bound due to Bennett's inequality with the Hoeffding's inequality and the Chernoff's inequality. Show appropriate plots to demonstrate your comparisons. (10)