

Indian Institute of Technology Dharwad, Karnataka, India

EE 221 / EE 201: Introduction to Probability / Data Analysis (first half)

Assignment 1 (Autumn 2021)

Due date: On or before 23rd Aug 2021, 23:59:59 IST

1. (5 points) **Switch or Stick:** You are a participant on a game show. There are three doors and hand-sanitizers are provided behind all the doors. But only one of the doors, also has a BMW car behind it. As the game show host, I know which door has the car. I ask you to pick one of the doors. Then, I open another door (not the one you chose) which only has the hand-sanitizer and ask you the question - “Do you want to switch to the other door or stick to the door you picked before?” Which strategy will have a higher probability of winning the car - switching or sticking? Justify your answer.
2. (10 points) **The Proposal:** In an alternate universe, you are about to propose to a girl/boy. Your love interest is expecting your move, since he/she understands expectations from “Introduction to Probability” very well. Before you even open your mouth, your love interest asks you to calculate $m = \mathbb{E}(X^n)$, where \mathbb{E} denotes the expected value, X is a random variable following a standard normal distribution and $n > 0$ is an odd number. He/she will accept your proposal if you solve for m correctly. What answer will you give so that your proposal is accepted?
3. (10 points) **Expectations will continue to hurt:** You go to a casino Las Vegas and choose a game based on tossing of a fair coin. This is a benevolent game, where you will get paid regardless of whether you get a “tail” or a “head”. You get \$1 for every coin toss, up to and including the first time a “head” comes up. Then, the amount per toss gets doubled whenever a “head” comes up. Let X_i denote the random variable corresponding to the i^{th} coin toss and Y_i denote the corresponding amount you get. Determine the average amount you win after N coin tosses.
4. (10 points) **I am Unique:** Let us say that you have a digit picker. You feed it a set of M digits and in each trial, it picks one of these M digits based on the PMF. All trials are independent. For example, one set corresponding to $M = 4$ can be $\{1, 3, 5, 9\}$ and the digit picker selects one of these four digits based on the PMF in each trial. Use this digit picker with your own set of M digits and your own PMF. Come up with a strategy that ensures that last seven digits of your roll number is selected with probability greater than or equal to 1%.
5. (5 points) **I am on my own:** Come up with a question of your own from Chapter 2 with the correct answer. The points are rewarded as follows.
 - 1 point if the question is trivial
 - 2 points if the question is easy
 - 3 points if the question is moderately difficult
 - 4 points if the question is difficult
 - 5 points if the question is something special (going beyond the topics in the book and lectures)

Note: Categorizing the question (and awarding points) is at the instructor’s discretion.