Stat 134 Fall 2018: Sample Midterm Questions

Adam Lucas

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This review sheet contains a selection of practice problems designed to help you prepare for the midterm. It is important to note however that this sheet contains only problems that the **uGSIs** believe are worth putting on the midterm and is far from comprehensive; you should use this sheet sparingly alongside other resources (such as reviewing lecture notes and recommended problems) to prepare for the midterm. Happy studying and best of luck next Friday!

Practice Midterm Problems

Before you start putting down answers, think about which topic we're testing you on. What distribution are you using? Why did you choose that distribution? Can you relate these problems to some problems you've seen/done before? What are the differences? Reflect on your thought process.

1. Flip a coin 8 times. Given that there are 3 heads, find the probability that:
   a. The heads are not consecutive.
   b. The heads are all next to each other.
   c. There are 2 heads next to each other, and 1 other head by itself.

2. An urn contains $n + 1 = 51$ marbles which are either black or white. Shake up the urn, and draw $n = 50$ marbles leaving one marble in the urn. Given that there are $k = 40$ black marbles from the first $n = 50$ draws, find the probability that the last ball in the urn is black.

3. In a room of n people, we are interested in finding out how many people share the same birthday. Assume as before that birthdays are independent and uniformly distributed across the year. Let N represent the number of people who share a birthday with at least one other person. Calculate $\mathbb{E}(N)$.

4. Let X be a Geometric (p) random variable on $\{1, 2, 3, \ldots\}$.

   a. Evaluate $\mathbb{E}(X^{-1})$. Hint: recall the Taylor series, $\log(1+x) = \sum_{n=1}^{\infty}(-1)^{n+1}\frac{x^n}{n}$.

   b. For p close to 1, what is this value, approximately? Your answer should be a very simple expression in terms of p.

5. Suppose there are two kinds of lottery tickets A and B. You buy A once a day and B once a week. You have a $1/25$ chance of winning A if you buy it, and a $1/4$ chance of winning B. You really want to win, so you keep buying both of them for a year (that is, 365 A tickets and 52 B tickets in total). Let X be the number of winning tickets you have in total. Find:

   a. $\mathbb{E}(X)$.

   b. $Var(X)$.

   c. Approximately $P(X = 18)$.