Stat 88 Fall 2019 **MIDTERM EXAM** **A. Adhikari**

NAME (FIRST LAST): _____ **SID:** _____

BUILDING (circle one): Stanley/LeConte **SEAT NUMBER:** _____

TIME AND CONDITIONS: You have 45 minutes to complete the exam. A reference sheet will be provided. No other materials are allowed; nor are calculators, computers, or the internet.

QUESTIONS AND ANSWERS

- There are 6 questions.
- **Give brief explanations or show calculations in each question** unless the question says this is not required. You may use, without proof, any result proved or used in lecture, the textbook, and homework, unless the question asks for a proof.
- Please leave answers as unsimplified arithmetic or algebraic expressions unless the question asks for a simplification.

GRADING

- The exam is worth 25 points. Each question is worth 4 points, and you get 1 additional point on the exam for writing your name and SID number on each page in the space provided. See Format below.
- Please commit yourself to a single answer for each question. If you give multiple answers (such as both True and False) then please don't expect credit, even if the right answer is among those that you gave.
- Please stop writing immediately when proctors announce that time is up, and please make no delay in following instructions to turn in your test. If you delay, you will be penalized 20% of your score in fairness to students who stop writing when instructed. See Honor Code below.

FORMAT

- There is a space for your name and SID number on one side of each page. Please fill this in. It will ensure that we can identify your work during the scanning process.
- There is space for your answer below each question. **Please do not write outside the black boundary**; the scanner and Gradescope won't read it.
- If you need scratch paper please use the back of the reference sheet. But be aware that we will not collect the reference sheet and it will not be graded.
- Please turn in only your exam, not the reference sheet.

HONOR CODE

Data Science and the entire academic enterprise are based on one quality – integrity. We are all part of a community that doesn't fabricate evidence, doesn't fudge data, doesn't present other people's work as our own, doesn't lie and cheat. You trust that we will treat you fairly and with respect. We trust that you will treat us and your fellow students fairly and with respect. **Please abide by UC Berkeley's Honor Code:**

"As a member of the UC Berkeley community, I act with honesty, integrity, and respect for others."

Your signature: _____

1. A random number generator draws digits at random with replacement from the 10 digits 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9. Let X be the number of times that the digit 9 appears in 20 draws. Find $P(X > 2)$.

2. A True/False test consists of 60 questions. A student knows the answers to 45 of the questions. The remaining 15 answers he guesses at random by tossing a fair coin each time. If it lands heads he answers True and if it lands tails he answers False.

A question is picked at random from the 60 questions on the test. Given that the student got the right answer, what is the chance that he knew the answer?

Name and SID: _____

3. There are 12 cookies on a plate. The number of chocolate chips in each cookie is random.

• Seven of the cookies are made by Choc-a-Bloc. In each Choc-a-Bloc cookie, the number of chocolate chips has the Poisson (10) distribution.

• Three of the cookies are made by Chips Away. In each Chips Away cookie, the number of chocolate chips has the Poisson (4) distribution.

• Two of the cookies are made by NoChipCo. In each NoChipCo cookie, the number of chocolate chips has the Poisson (1) distribution.

Let N be the number of chocolate chips in a cookie picked at random from the plate. Find $E(N)$.

4. Down's Syndrome is a chromosomal disorder (a type of unusual genetic condition) that is associated with maternal age: older mothers are more likely to have babies with this syndrome than younger mothers are. The authors of an article on this syndrome define "births to older mothers" as births in which the mother's age is at least 40 years, and "births to younger mothers" as births in which the mother is younger than 40. The authors make two statements about births in the US:

• Among births to **older** mothers, Down's Syndrome appears more frequently than it does among births to younger mothers.

• Among births with Down's Syndrome, **younger** mothers appear more frequently than older mothers.

Use what you know about probability to **briefly** explain why the two statements don't contradict each other.

5. At a local airport, every flight operated by a budget airline has a 99% chance of being overbooked. Ten flights operated by the airline are scheduled to depart from the airport in the next hour. Find the chance that all 10 of the flights are overbooked, if it is possible to get an exact value with the information given. If it is not possible to find the chance exactly, then find the best lower and upper bounds you can.

6. Two versions of a treatment are being examined in a randomized controlled experiement. The experiment has 300 participants. The participants are randomized into three groups of equal size as follows:

Stage 1: A simple random sample of 100 participants drawn from all 300 are assigned to Treatment Group 1.

Stage 2: From the participants not assigned to Treatment Group 1, a simple random sample of 100 are assigned to Treatment Group 2.

Stage 3: All participants not assigned to the treatment groups are assigned to the Control Group.

Among the 300 participants, 180 are smokers. Find the expected number of groups that contain more than 60 smokers.