

NAME (FIRST LAST): _____ SID: _____

TIME AND CONDITIONS: You have 50 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.
- Please do not leave answers as an infinite sum. **Answers left as an infinite sum will not receive full credit.**

GRADING

- The exam is worth 30 points. Each question is worth 5 points.
- 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 box has three coins with probability of landing head 0.3, 0.5, 0.9. You randomly reach in the box and grab one of the coins. What is the expected numbers of flips till you get a head?.

2. A woman's DNA matches that of a sample found at a crime scene. If the woman is guilty the chances of a DNA match is virtually 100% (i.e. the chance of a false negative is essentially zero). Can we say that given a DNA match, the woman must be guilty? Explain your reasoning fully using the concepts discussed in Stat 88.

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3. You're curious to find out the chance that UC Berkeley students are ambidextrous (the rare ability to be both left and right handed). Using historical data, you find out that men students have a $\frac{1}{500}$ chance of being ambidextrous, independent from other men. On the other hand, women students have a $\frac{1}{250}$ chance of being ambidextrous, independent from other women. Assume independence across men and women.

a) Suppose there's a sample of 100 men and another sample of 100 women. What is the chance that both samples have an equal number of students that are ambidextrous?

b) Suppose now that there's a sample of 1000 men and another sample of 1000 women. Let T be the total number of students that are ambidextrous from both samples. What is the **approximate** distribution of T ? Use this distribution to find $P(T > 10)$.

4. There are two jars, each containing r red marbles and b blue marbles. A marble is chosen at random from the first jar and placed in the second jar. A marble is then randomly chosen from the second jar. Find the probability this marble is red.

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5. A class of 60 students includes 20 seniors. For a group project, the class is split at random without replacement into 10 groups of 6 students each. Find the expected number of groups that contain no seniors.

6. A die has 2 red faces and 4 green faces. The die is rolled 13 times. Given that green faces appeared exactly 7 times in 13 rolls, what is the chance that the green faces appeared exactly 3 times in the first 5 rolls?

Please look to see if you can simplify your answer algebraically.