Name: ____________ TA Name: ____________ Secret Word: ____________

Data 88S

March 13, 2024

Chapter 5, Exercise 12

1. A coin is tossed four times. Let X be the number of heads in the first three tosses and Y the number of heads in the last three tosses.

   (a) The distribution of Y is one of the famous ones. Provide its name, parameters, and expectation.

   (b) For each possible value x of X, find $E(Y|X = x)$. Your answer to 5c will be helpful.

   (c) Find $E(Y)$ by conditioning on X, and confirm that the result is the same as your answer to Part a.

Chapter 5, Exercise 13

2. A survey organization in a town is studying families with children. Among the families that have children, the distribution of the number of children is as follows.

Number of Children n	1	2	3	4	5
Proportion with n **Children**	0.2	0.4	0.2	0.15	0.05

   Suppose each child has chance 0.51 of being male, independently of all other children. What is the expected number of male children in a family picked at random from those that have children?

Name: ____________ TA Name: ____________ Secret Word: ____________

Chapter 5, Exercise 10

3. Five thousand votes have been cast in an election. Each vote is either for Candidate A or for Candidate B. The voting is over but the results have not yet been announced.

   A polling organization wants to estimate the margin of victory for Candidate A. This parameter is defined as the proportion of votes for Candidate A minus the proportion of votes for Candidate B. Note that this margin of "victory" could be negative if Candidate B gets more votes than Candidate A.

   The polling organization conducts an exit poll by surveying a simple random sample of 100 voters after all of the 5000 voters have finished voting.

   (a) Let p be the proportion of the 5000 voters who voted for Candidate A. Express the margin of victory in terms of p.

   (b) Let X be the number of sampled voters who voted for Candidate A. Use X to construct an unbiased estimator of the margin of victory.

4. Bella chooses an integer X uniformly at random from 1 to 425. She then chooses an integer Y uniformly at random from $1, \ldots, X$. Find $E(Y)$.

5. Bella chooses an integer N at random from $Pois(\mu)$. She then picks N cards from a deck with replacement. Find the expected number of ace cards.