

Your name(s):

DAY 5: CDF, BINOMIAL, POISSON, LINEAR FUNCTIONS
SEC 2.3-2.5

1. Consider a discrete random variable X with a geometric density function:

$$p_k = \Pr(X = k) = (1 - p)^{k-1}p, \quad 0 < p < 1, \quad k = 1, 2, 3, \dots$$

Determine the CDF for this random variable. Sketch a graph of the CDF when $p = 1/2$.

2. A multiple-choice exam has 15 questions, each with five possible answers, only one of which is correct. Suppose that one of the students who takes the exam answers each of the questions with an independent random guess. What is the probability that he answers at least two-thirds of the questions correctly?
3. Suppose that each birth of a baby is equally likely to be a male or a female.
- (a) Given that a family has exactly n children, $n = 1, 2, \dots$, what is the probability that exactly k of them are female, $k = 0, 1, \dots, n$?
 - (b) As you know from experience, not all families have the same number of children. A good approximation to the distribution of family size is the Poisson distribution, with mean 2.25. Thus the probability that a family will have exactly n children is $(2.25)^n e^{-2.25} / n!$. What fraction of families will have exactly two boys and two girls?
 - (c) What is the probability that a family will have children both sexes?
4. Suppose that we survey 20 individuals working for a large company and ask each whether they favor implementation of a new policy regarding retirement funding. If in our sample, 6 favored the new policy, find a maximum likelihood estimate for p , the true but unknown proportion of employees that favor the new policy.
5. A particular type of tire does not hold up well for vehicles on unpaved roads in a rural Western state. Vehicles get their front tires replaced on an average of two per year, while rear tires get replaced on an average of one and a half per year. Assuming the replacement of front tires is independent of replacement of rear tires, what is the probability that a random vehicle has two of its tires replaced within a given year?
6. An oil company wishes to estimate how likely it is to strike oil when a single well is drilled. By experimentation, the company strikes oil for the 3rd time on the 7th well it drills. Use the maximum likelihood method to estimate p , the probability of successfully striking oil when a single well is drilled.
7. Let p equal the proportion of Americans who favor the death penalty. If in a random sample of 1234 individuals, 864 Americans said they favor the death penalty, find an approximate 95% confidence interval for p .