

MATH 464 (THEORY OF PROBABILITY)
HOMEWORK 4

SPRING 2019
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- (1) Suppose we roll two dice and let X be the minimum of the two numbers obtained. Determine the probability function of X .
- (2) In successive rolls of a die, let X be the number of rolls until the first 4 appears. Determine the probability function of X .
- (3) Privacy is a concern for many users of the Internet. One survey showed that 79% of Internet users are somewhat concerned about the confidentiality of their e-mail. Based on this information, what is the probability that for a random sample of 12 Internet users, 7 are concerned about the privacy of their e-mail?
- (4) A student has no knowledge of the material to be tested on a true-false exam with 10 questions. So, the student flips a fair coin in order to determine the response to each question.
 - (a) What is the probability that the student answers at least six questions correctly?
 - (b) What is the probability that the student answers at most two questions correctly?
- (5) A pediatrician reported that 30 percent of the children in the U.S. have above normal cholesterol levels. If this is true, find the probability that in a sample of fourteen children tested for cholesterol, more than 10 will have above normal cholesterol levels.
- (6) An insurance company insures 15,000 people, each of whom has a $1/5000$ chance of an accident in one year. Use the Poisson approximation to find the probability that the number of accidents in one year will be at least 2 and at most 4.
- (7) Suppose only 1% of lottery tickets in a certain state win. In the questions below, use Poisson approximation:
 - (a) Suppose Jim buys 300 tickets. What is the chance that he wins anything?
 - (b) What is the chance that Jim has at least two winning tickets?
- (8) An airline company sells 200 tickets for a plane with 198 seats, knowing that the probability a passenger will not show up for the flight is 0.01. Use the Poisson approximation to compute the probability they will have enough seats for all the passengers who show up.
- (9) A certain rare blood type can be found in only 0.05% of people. Use the Poisson approximation to compute the probability that at most two persons in a group of randomly selected 3000 people will have this rare blood type.
- (10) Let X be a geometric random variable with parameter p . Prove that

$$P(X \geq m + n \mid X > m) = P(X \geq n)$$

for any positive integers m and n . Explain what it means, in terms of trials till the first success. This property is called the *memoryless property* of a discrete random variable (that takes values $1, 2, \dots$).