

Probabilities & Data (MATH4043)

SP2 2020

Tutorial Questions Week 4 (Discrete Probability Distribution)

- The number of messages sent per hour over a computer network has the following distribution: Determine the mean and standard deviation of the number of messages sent per hour.

$x = \text{number of messages}$	10	11	12	13	14	15
$p(x)$	0.08	0.15	0.30	0.20	0.20	0.07

Sketch the probability mass function for the number of messages sent per hour over the computer network. Calculate the probability of receiving 13 or fewer messages per hour over the computer network. Sketch the cumulative probability function.

- Shape of the Binomial Distribution:* Figure 1 compares the shapes of the distributions for p equal to 0.05, 0.50 and 0.95, all for n equal to 5. Describe the effect of varying probability of success in a single trial when the number of trials is 5.

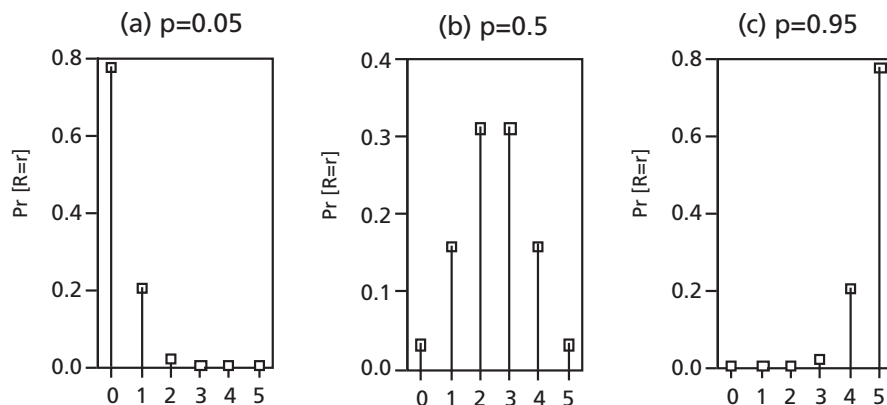


Figure 1: The effect of varying probability of success in a single trial when the number of trials is 5.

- A company is considering drilling four oil wells. The probability of success for each well is 0.4, independent of the results for any other well. The cost of each well is \$200,000. Each well that is successful will be worth \$600,000. The binomial distribution applies. Calculate the probability of each possible result and answer the following:
 - What is the probability that one or more wells will be successful?
 - What is the expected number of successes?
 - What is the expected gain?
 - Considering all possible results, what is the probability of a loss rather than a gain?
 - What is the standard deviation of the number of successes?

4. The number of meteors found by a radar system in any 30-second interval under specified conditions averages 1.81. Assume the meteors appear randomly and independently.
 - (a) What is the probability that no meteors are found in a one-minute interval?
 - (b) What is the probability of observing at least five but not more than eight meteors in two minutes of observation?
5. The average number of collisions occurring in a week during the summer months at a particular intersection is 2.00. Assume that the requirements of the Poisson distribution are satisfied.
 - (a) What is the probability of no collisions in any particular week?
 - (b) What is the probability that there will be exactly one collision in a week?
 - (c) What is the probability of exactly two collisions in a week?
 - (d) What is the probability of finding not more than two collisions in a week?
 - (e) What is the probability of finding more than two collisions in a week?
 - (f) What is the probability of exactly two collisions in a particular two-week interval?
6. We are told that 5% of the tools produced by a certain process are defective. Find the probability that in the sample of 40 tools chosen at random, exactly three will be defective. Calculate
 - (a) using the binomial distribution, and
 - (b) using the Poisson distribution as an approximation.