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Chapter 2: Random Variables

Discrete vs Continuous Variables

Problem 1: Random-Variables

Suppose our experiment is to toss a single fair die, and we are interested in the number rolled. We define our random variable X to be the outcome of a single die roll.

(a) Why is the variable X a random variable?

(b) What are the possible values that the random variable X can take?

(c) What is the notation used for rolling a 5?

(d) Use random variable notation to express the probability of rolling a 5.

Problem 2: Random-Variables

Identify each as a discrete or continuous random variable.

(a) Total amount in ounces of soft drinks you consumed in the past year.

(b) The number of cans of soft drinks that you consumed in the past year.

Chapter 4: Probability Distribution Functions

Binomial Distribution

Problem 3: Binomial-Distribution-Probability

Find the probability that in a family of four children there will be

(a) at least one boy

(b) at least one boy and at least one girl

Assume that the probability of male birth is $1/2$.

Problem 4: Binomcdf-probability

What is the probability of at least four successful trials in a random experiment, with probability of success of a single trial being 8% if twenty trials are run?

Problem 5: Binomial-Distribution-Probability

If 20% of the bolts produced by a machine are defective, determine the probability that out of four bolts chosen at random,

(a) one bolt will be defective

(b) zero bolts will be defective

(c) less than 2 bolts will be defective

Problem 6: Binomial-Distribution-Probability

Find the probability of getting a total of 7 at least once in three tosses of a pair of fair dice.

Chapter 4: Probability Distribution Functions

Binomial Distribution

Problem 7: Visualizing-Binomial-Distribution

Suppose that a coin is tossed three times so that the sample space is

$$S = \{HHH, HHT, HTH, HTT, THH, THT, TTH, TTT\}.$$

Let X represent the # of heads that can come up. Create a table for its Probability Distribution Function (PDF) and draw its histogram. Test if the sum of probability is 1.

x	$P(x)$

Problem 8: Visualizing-Binomial-Distribution

Find the probability distribution of girls in a family of 6 children, assuming fair probability ($p = 0.5$). Note: This is a binomial distribution.

x	$P(x)$

(a) What is the probability that the couple will have at most 4 girls?

(b) Find the mean and standard deviation of the binomial pdf. You can use the formula $\sigma = \sqrt{\frac{\Sigma(x-\mu)^2}{n}}$, or use your calculator.

Normal Distribution

Problem 9: Normal-Distribution

The mean inside diameter of a sample of 200 washers produced by a machine is 0.502 inches and the standard deviation is 0.005 inches. The purpose for which these washers are intended allows a maximum tolerance in the diameter of 0.496 to 0.508 inches, otherwise the washers are considered defective. Determine the percentage of defective washers produced by the machine, assuming the diameters are normally distributed.

(a) Determine the percentage of defective washers produced by the machine, assuming the diameters are normally distributed.

(b) If 100,000 washers are produced in a day, how many defective washers are produced each day?

Problem 10: Normal-Distribution

If the heights of 300 students are normally distributed with mean 68.0 inches and standard deviation 3.0 inches, how many students have heights

(a) greater than 72 inches?

(b) less than or equal to 64 inches?

(c) between 65 and 71 inches inclusive?

(d) equal to 68 inches?

Assume the measurements to be recorded to the nearest inch.

Standard Normal Distribution

Problem 11: Standard-Normal-Distribution

Find the area under the standard normal curve

(a) between $z = 0$ and $z = 1.2$

(b) between $z = 0.68$ and $z = 0$

(c) between $z = 0.46$ and $z = 2.21$

(d) between $z = 0.81$ and $z = 1.94$

(e) to the right of $z = 1.28$

Problem 12: Convert-z-values

Convert each of the following between x and z values.

(a) $x = 35$ where $\mu = 40$, $\sigma = 2$

(b) $x = 130$ where $\mu = 100$, $\sigma = 12$

(c) $z = -0.57$ where $\mu = 14$, $\sigma = 1.5$

Problem 13: Standard-Normal-Distribution

The mean weight of 500 male students at a certain college is 151 lb and the standard deviation is 15 lb. Assuming that the weights are normally distributed, find without using a calculator how many students weigh

(a) between 120 and 155 lb

(b) more than 185 lb.

Inverse Normal Distribution

Problem 14: Inverse-Normal-Distribution

The mean inside diameter of a sample of 200 washers produced by a machine is 0.502 inches and the standard deviation is 0.005 inches.

(a) What is the inside diameter of the largest washer produced from the bottom ten percent of the washers produced?

(b) What is the inside diameter of the smallest washer produced from the top ten percent of the washers produced?

Problem 15: Inverse-Normal-Distribution

If the heights of 300 students are normally distributed with mean 68.0 inches and standard deviation 3.0 inches,

(a) what is the height of the tallest student in the bottom 17th percentile?

(b) what is the height of the shortest student in the top 97th percentile?

Assume the measurents to be recorded to the nearest inch.