

Math 140: Thursday, Oct 31, Day 17 Notes

Agenda for Thursday, Oct 31, 2024

Finish Probability !!!

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Coming up

- ! Online HW 10 due Tuesday and Online HW 11 posted today
- Breakfast at Tutoring - Monday, November 4th, 8 am - 11 am, Grayslake Tutoring Center (L135)



Binomial Distribution

Next, we will look into a special discrete probability distributions called **Binomial Distributions**.

There are **four conditions** that the experiment has to meet to be considered a **binomial experiment**:

- Condition 1:
- Condition 2:
- Condition 3:
- Condition 4:

Example 1. Are the following binomial experiment:

a) Randomly guessing at a multiple-choice question with 4 possible answers has only two outcomes. If a success is guessing correctly, then a failure is guessing incorrectly. Suppose there are 6 multiple choice questions. Joe guesses on each question with no pattern.

- Condition 1:
- Condition 2:
- Condition 3:
- Condition 4:

b) Randomly guessing at a multiple-choice question has only two outcomes. If a success is guessing correctly, then a failure is guessing incorrectly. Suppose there are 6 multiple choice questions. The first 3 questions have 4 choices, and the last 3 questions have 5 choices each. Cesar guesses on each question with no pattern. Determine if this is a binomial experiment.

- Condition 1:
- Condition 2:
- Condition 3:
- Condition 4:

c) Cyanosis is the condition of having bluish skin due to insufficient oxygen in the blood. About 80% of babies born with cyanosis recover fully. A hospital is caring for 10 babies born with cyanosis. The random variable represents the number of babies that recover fully.

- Condition 1:
- Condition 2:
- Condition 3:
- Condition 4:

Notation and Properties of the Binomial distribution

- The outcomes of a binomial experiment fit a binomial probability distribution.
- We say the random variable $X =$ is a binomial random variable and we write
- To find the probability that our random variable X takes on a certain value (denoted k) we use the following formula:

$$P(x = k) = \mathbf{binomialpdf(n, p, k)}$$

- To find the probability that our random variable X takes on values less than or equal to a certain value (denoted k) we use the following formula:

$$P(x \leq k) = \mathbf{binomialcdf(n, p, k)}$$

- The **mean** of a binomial probability distribution is

Example 2. Randomly guessing at a multiple-choice question with 4 possible answers has only two outcomes. If a success is guessing correctly, then a failure is guessing incorrectly. Suppose there are 6 multiple choice questions. Mayra guesses on each question with no pattern.

- a) Find the probability of Mayra guessing correctly exactly 3 questions.
- b) Find the probability of Mayra guessing correctly all of the questions.

- c) Find the mean or expected number of questions Mayra guesses correctly.

Example 3. It has been stated that about 41% of adult workers have a high school diploma but do not pursue any further education. 20 adult workers are randomly selected.

- a) Find the probability that **exactly** 2 of them have a high school diploma but do not pursue any further education.
- b) Find the probability that **at most** 12 of them have a high school diploma.
- c) Find the probability that **at least** 6 of them have a high school diploma.
- d) Find the probability that **more than** 10 of them have a high school diploma.
- e) Find the probability that **less** 5 of them have a high school diploma.
- f) How many adult workers do you **expect** to have a high school diploma but do not pursue any further education?