

Math 142: Wednesday, Oct 23rd, Day 18 Notes

Agenda for Wednesday, Oct 23rd 2024	
Example with Expected Value from previous Day notes	1
Chpater 5 Random Variables - Binomial Random Variable	1

Coming up

- Student Hours Tuesday today 3:45pm-5pm in C162
- HW 13 due on Monday
- Excel Assignment 3 will be posted today and due next Wednesday

Recall:

From previous day:

Example 1. A charity organization is selling \$5 raffle tickets as part of a fund-raising program. The first prize is a trip to Mexico valued at \$3450, and the second prize is a weekend spa package valued at \$750. The remaining 10 prizes are \$25 gift cards. The number of tickets sold is 6000. Find the expected value of a single raffle ticket.

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 2. Are the following binomial experiment:

1. 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:

2. 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:

3. 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:

$$P(x = k) =$$

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

The **variance** of a binomial probability distribution is

The **standard deviation** is

Example 3. 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.

1. Find the probability of Mayra guessing correctly exactly 3 questions.
2. Find the probability of Mayra guessing correctly all of the questions.

3. Find the mean or expected number of questions Mayra guesses correctly.
4. Find the standard deviation of the correct guesses.
5. Create the binomial probability distribution.

all values of the random variable X	corresponding probabilities: P(X)

6. Find the probability of Mayra guessing correctly at most 3 questions.

Binomial distribution with calculator and Excel

There two functions in the calculator that calculate binomial probabilities.
Press 2nd then **vars** to get to Distr



followed by



The two functions are:

- $\text{binomialpdf}(n, p, k)$
- $\text{binomialcdf}(n, p, k)$

Excel Instructions:

- Type =BINOM.DIST(k, n, p, FALSE) to find probabilities of the type $P(x = k)$.
- Type =BINOM.DIST(k, n, p, TRUE) to find probabilities of the type $P(x \leq k)$.

Example 4. 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.

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