Math 140: Binomial Distribution

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:

  $P(x = k) =$ **binomialpdf(n, p, k)**

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

  $P(x = k) =$ **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?