



*when you realize your instructor needs to quarantine and you will only have fun  
online lectures instead of fun in person lectures*

# Today's Agenda

## Last time:

- Negative Binomial + Geometric Distribution
- Memoryless property of the geometric distribution
- Poisson distribution

We have covered everything up to and including Section 5.7!

## Today (Lec 15, 06/08):

- Practice, Practice, Practice

## Next Lectures:

- Lec 16 (recorded) covers the remaining material in Chapter 5 and will be posted by June-09
- Lec 17 (synchronous online lecture on June-10) consists of practice and review of Chapter 5

## Distributions covered so far:

- Discrete Uniform Distribution
- Bernoulli Distribution
- Hypergeometric Distribution
- Binomial Distribution
- Negative Binomial + Geometric Distribution
- Poisson Distribution

## Question 1

What is the relationship between geometric and negative binomial distribution?

- A) They are both discrete
- B) They both model the number of failures given a fixed number of successes
- C) Geometric is a special case of negative binomial

## Question 2

Dwight flips a fair coin until he got  $k$  heads. As a result, he got  $r$  tails as well. In how many ways could this have happened?

A)  $\binom{k}{r}$

B)  $\binom{k+r}{k}$

C)  $\binom{k+r}{r}$

D)  $\binom{r+k-1}{k-1}$

## Question 3

Suppose  $A$  and  $B$  are mutually exclusive, and that  $P(A) = P(B) = 1/4$ . Are  $A$  and  $B$  independent?

- A) Yes
- B) No
- C) This information is not sufficient to determine whether or not  $A$  and  $B$  are independent.

## Question 4

Suppose a fair coin is flipped 17 times. Let  $X$  denote the the number of heads observed, and let  $Y$  denote the number of tails observed. Which of the following is FALSE:

A)  $X \sim \text{Binomial}(17, .5)$

B)  $Y \sim \text{Binomial}(17, .5)$

C)  $X \sim Y$

D)  $X + Y = 17$

E)  $X = Y$

## Question 5

An urn contains 7 red marbles, 13 blue marbles, and 3 green marbles. Suppose that 5 marbles are drawn from the urn with replacement. Let  $X$  denote the number of blue marbles observed in the 5 draws. What is the distribution of  $X$ ?

- A)  $X \sim U(1, 5)$
- B)  $X \sim \text{Binomial}(5, 7/23)$
- C)  $X \sim \text{hyp}(23, 13, 5)$
- D)  $X \sim \text{Binomial}(5, 13/23)$
- F)  $X \sim \text{Binomial}(23, 5/13)$



## Question 6

The range of a random variable is  $A = \{1, 2, 3, \dots\}$ . For  $x \in \{0, 1, 2, \dots\}$  the cumulative distribution function of  $X$  is given by

$$F(x) = P(X \leq x) = 1 - 2^{-x}.$$

- A) Find  $P(X = 5)$  and  $P(X \geq 5)$ .
- B) Find the probability function  $f(x) = P(X = x)$ .

## Question 7

A manufacturer of auto parts just shipped 25 auto parts to a dealer. Later on, it was discovered that 5 of those parts were defective. By the time the company manager contacted the dealer, 4 auto parts from that shipment had been sold. Denote by  $X$  the number of good parts sold. What is the distribution of  $X$ ?

## Question 8

At Skip The Dishes, home delivery providing high-quality service to customers is the top priority of the management. The company guarantees a refund of all charges if your meal is not delivered within 40 minutes of placing your order. Through past history, it is known that 2% of the deliveries do not arrive within the 40 minutes. Suppose Skip The Dishes receives 10 orders during a specific hour.

- A) Find the probability that exactly 1 of these orders is not delivered within 40 minutes.
- B) Find the probability that at most 1 of these orders is not delivered within 40 minutes.

## Question 9

A start-up company is looking for 5 investors. Each investor will independently agree to invest in the company with probability 20%. The founder asks investors one at a time until 5 “yes” responses are obtained. Let  $X$  represent the total number of investors asked.

Write down the probability function of  $X$ .

## Question 10

Suppose that the probability is 0.75 that an applicant for a driver's license will pass the road test on any given attempt. What is the probability that an applicant will finally pass the test on the fourth attempt?

## Question 11

Suppose  $X$  is a discrete random variable and  $a, b \in \mathbb{R}$  with  $a < b$ . Then

$$P(X > a) \geq P(X > b).$$

TRUE or FALSE?