# CVE 303. Probability and Statistics. A

In each of the problems below, write the distribution of the random variable X: Bernoulli, Binomial, HyperGeometric, Geometric, Negative Binomial, Poisson
Also give values for all of the parameters.

1. At a beach in Cyprus, approximately $1/3$ of the fish are wrasse. Swimming one afternoon you see 100 fish. Let X be the number of wrasse.

↳ Count #Wrasse out of 100 fish
- P(Wrasse) = 1/3

$X \sim \text{Binomial}(100, 1/3)$

2. Suppose that $1/10$ of cereal boxes contain a special surprise prize. Let X be the number of boxes of cereal you eat before you get a prize.

↳ Count #Box without prize before prize
- P(Prize) = 1/10

$X \sim \text{Neg. Binom.}(1, 1/10)$
— or —
$X \sim \text{Geometric}(1/10)$

3. Watching the cars on a road, you see on average one BMW every 2 minutes. Let X be the number of BMW's you see in 10 minutes.

↳ Count #BMW in 10 minutes
- Expected # = 10/2 = 5

$X \sim \text{Poisson}(5)$

4. 100 people are in a movie theater. $4/5$ of them are watching the movie for the first time. 10 people are on the front row. Let X be the number of front row people who are watching the movie for the first time.

↳ Count #People seeing movie for 1st time in sample of size 10

$X \sim \text{HyperGeom.}(80, 20, 10)$

- Total # Seeing movie 1st time = $100 \cdot 4/5 = 80$
- Total # Seeing movie again = $100 \cdot 1/5 = 20$

5. A fussy tinder user swipes left approximately $9/10$ of the time. Let X be the number of left swipes before there are 4 right swipes.

↳ Count # Left swipes before 4 right

- P(Left swipe) = 9/10
- P(Right swipe) = 1/10

$X \sim \text{Neg. Binom}(4, 1/10)$

# CVE 303. Probability and Statistics. B

In each of the problems below, write the distribution of the random variable X: Bernoulli, Binomial, HyperGeometric, Geometric, Negative Binomial, Poisson
Also give values for all of the parameters.

1. At a beach in Cyprus, you see on average 2 wrasse every 3 minutes. Let X be the number of wrasse you see in one hour.

↳ Count # Wrasse in 1 hour

• Expected # $= \left(\frac{2 \text{ Wrasse}}{3 \text{ Min}}\right)\left(\frac{60 \text{ Min}}{1 \text{ Hour}}\right)$

$= 40$ Wrasse/Hr

$X \sim \text{Poisson}(40)$

2. A store has 100 boxes of cereal and $1/10$ of them contain a special surprise prize. You buy 20 boxes. Let X be the number of boxes you have with prizes.

↳ Count # Boxes with prize in sample of size 20

• Total # Prize $= 100 \cdot 1/10 = 10$

$X \sim \text{HyperGeom}(10, 90, 20)$

• Total # Without Prize $= 100 \cdot 9/10 = 90$

3. Watching the cars on a road, $1/15$ of the cars are BMWs. Let X be the number of cars that pass before the first BMW.

↳ Count # not BMW before BMW

• $P(\text{BMW}) = 1/15$

$X \sim \text{Neg. Binom.}(1, 1/15)$

— or —

$X \sim \text{Geometric}(1/15)$

4. People are in a movie theater. $4/5$ of them are watching the movie for the first time. You start asking people about the movie. Let X be the number of people you meet who haven't seen the movie before you meet 5 people who have.

↳ Count # have not seen movie before 5 have seen it

$X \sim \text{Neg. Binom.}(5, 1/5)$

• $P(\text{have not seen}) = 4/5 \Rightarrow P(\text{have seen}) = 1/5$

5. A fussy tinder user swipes left approximately $9/10$ of the time. Let X be the number of left swipes in the first 20 swipes.

↳ Count # Left swipes out of 20 swipes

• $P(\text{Left swipe}) = 9/10$

$X \sim \text{Binomial}(20, 9/10)$

# CVE 303. Probability and Statistics. C

In each of the problems below, write the distribution of the random variable X: Bernoulli, Binomial, HyperGeometric, Geometric, Negative Binomial, Poisson
Also give values for all of the parameters.

1. At a beach in Cyprus, approximately $1/3$ of the fish are wrasse. You catch 90 fish, 30 of which are wrasse. As you walk to the car, 20 fish escape. Let X be the number of wrasse that escaped.

↳ Count #Wrasse in sample of size 20
- Total #Wrasse = 30
- Total # Others = 90 - 30 = 60

$X \sim \text{HyperGeom}(30, 60, 20)$

2. Suppose that $1/10$ of cereal boxes contain a special surprise prize. Let X be the number of prize-less boxes of cereal you eat before you gather 5 prizes.

↳ Count # no prize before 5 prizes
- P(Prize) = 1/10

$X \sim \text{Neg. Binom}(5, 1/10)$

3. Watching the cars on a road, $1/15$ of the cars are BMWs. You count 100 cars passing by. Let X be the number of BMWs you saw.

↳ Count #BMW out of 100 total cars
- P(BMW) = 1/15

$X \sim \text{Binomial}(100, 1/15)$

4. People are in a movie theater. $4/5$ of them are watching the movie for the first time. Let X be the number of people you must ask before you find someone who is watching for the first time.

↳ Count # People not 1st time before 1st time person
- P(1st time) = 4/5

$X \sim \text{Neg. Binom.}(1, 4/5)$
— or —
$X \sim \text{Geometric}(4/5)$

5. A fussy tinder user swipes right on average 2 times during every 5 minutes of browsing. Let X be the number of right swipes during 30 minutes on tinder.

↳ Count # Right swipes in 30 min
- Expected # = $\left(\frac{2 \text{ Right}}{5 \text{ minutes}}\right)(30 \text{ minutes})$
  = 12 Right

$X \sim \text{Poisson}(12)$