8. Let's do some statistics

The first example

Those numbers change.

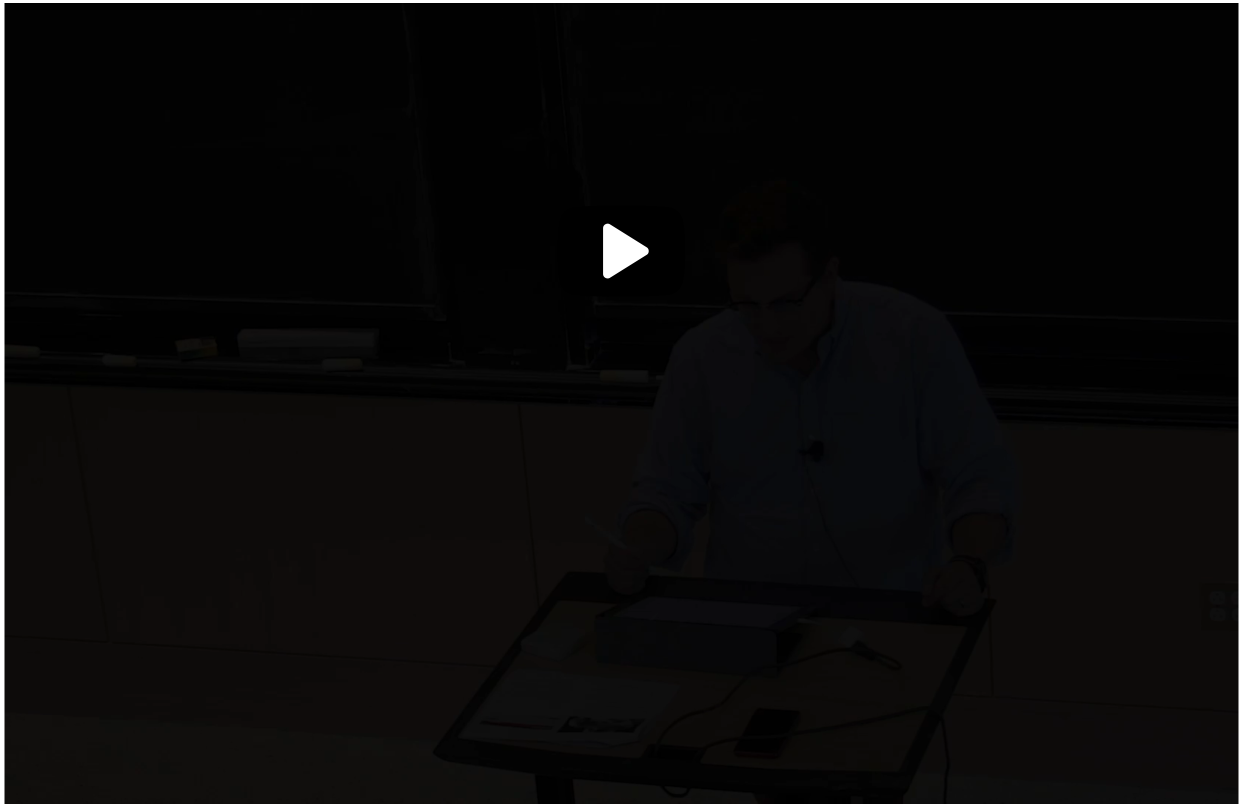
How far do they fluctuate?

Is this number going to be sometimes everybody is 0?

Sometimes everybody is 1?

In which case, I'm going to fluctuate between having p-hat

which is 0 or p-hat which is 1.



Or I'm going to have numbers that sort of tend to be clumped

around the same true number p.

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13:09 / 13:09 1.50x

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Review: probability question

1/1 point (graded)

Assume that we observe three draws, X_1, X_2, X_3 from a Bernoulli distribution with parameter $p = \frac{1}{2}$. For example, imagine that in the model for the preferred head direction for kissing, either direction were actually equally likely and we observed three kissing couples.

What is the probability of observing at least two ones, i.e., what is $\mathbf{P}\left(\sum_{i=1}^{3} X_i \geq 2\right)$?

1/2

Answer: 0.5

Solution:

$\sum_{i=1}^{3} X_i$ follows a Binomial distribution with parameters $n = 3$ and $p = \frac{1}{2}$, hence the probability in question is

$$\mathbf{P}\left(\sum_{i=1}^{3} X_i \geq 2\right) = \binom{3}{2}\left(\frac{1}{2}\right)^3 + \binom{3}{3}\left(\frac{1}{2}\right)^3 = \frac{4}{8} = \frac{1}{2}.$$

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You have used 2 of 3 attempts

Answers are displayed within the problem

Confidence, continued

1/1 point (graded)

If in the model above, let us assume we decided to consider two or more right-turns as significant evidence for a predisposition of this direction for kissing. Now, 10 students go out and each observe three different couples kissing. How many of them would on average come to the conclusion that right-leaning is more common than left-leaning when kissing?

5

✔ **Answer:** 5

Solution:

We just computed the chance for one of these events to occur to be $\frac{1}{2}$, so if we perform 10 repeats, we expect it to happen 5 times.

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You have used 1 of 3 attempts

Answers are displayed within the problem

Friendships

1/1 point (graded)

In a group of n people indexed 1 through n, each pair (i, j) (there are $\binom{n}{2}$ of them) are either friends, or not friends. To model this situation, we assign a random variable to each pair. Which one of the probability distributions below is the most appropriate model?

- A Poisson random variable.

- A Gaussian random variable.
- A Bernoulli random variable.
- An exponential random variable.

Solution:

We need a random variable, which takes only two values (for convenience, 1 for being friends; and 0 for strangers), and this is precisely a Bernoulli distribution.

Submit You have used 1 of 3 attempts

Answers are displayed within the problem

Friendships (Continued)

2/2 points (graded)
With the setup as in the problem above, we say a group of four people is “interesting", if there are at most five pairs who are friends. Assume that each pair of people are friends, independent of every other pair, with probability $1/2$. Let N be the number of pairs that are friends in this group.

- What distribution does N follow?

- Poisson
- Bernoulli
- Binomial

- What is the probability that a randomly chosen group of four people is “interesting"? (Enter your answer as a fraction (recommended) or enter as a decimal accurate to nearest 0.001.)

$\mathbb{P}(N \leq 5) =$ 63/64 **Answer:** 63/64

Solution:

- There are, in total, $\binom{4}{2} = 6$ different pairs. Notice that N is a random sum of 6 Bernoulli trials; this is a binomial random variable: $N \sim \mathrm{Bin}(6, 1/2)$.
- $\mathbb{P}(N \leq 5) = 1 - \mathbb{P}(N = 6) = 1 - (1/2)^6$.

Submit You have used 1 of 3 attempts

Answers are displayed within the problem

How many interesting groups?

1/1 point (graded)

Following the model above, if 128 different people each observe one randomly chosen groups of four people, how many times on average do these observations lead to the conclusion that the person's chosen group is interesting?

126

Answer: 126

Solution:

We just computed the chance for one of these events to occur to be $1 - 1/64$, so if we perform 128 repeated experiments, we expect it to happen $128\left(1 - \frac{1}{64}\right) = 126$ times.

Submit

You have used 1 of 3 attempts

Answers are displayed within the problem

Discussion

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[staff]: great set of exercises, thanks

I see everybody else is sailing through quite easily here, but as a struggler (my maths/stats are 20y+ old), I wanted to say i find these exercises and q...

3

? [STAFF] Hi, can you please check if the answer to "How many interesting groups?" is correct?
[STAFF] Hi, can you please check if the answer to "How many interesting groups?" is correct? I think the estimated probability that is used to calculate... 14

How to interpret this, anyone?
We say a group of four people is “interesting", if there are at most five pairs who are friends. group of 4 has 5 pairs ? 9

? [Problem 5] What's t?
It's not mentioned elsewhere in the problems, as far as I can see, and it seems to be an unconventional choice for a probability. 6

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