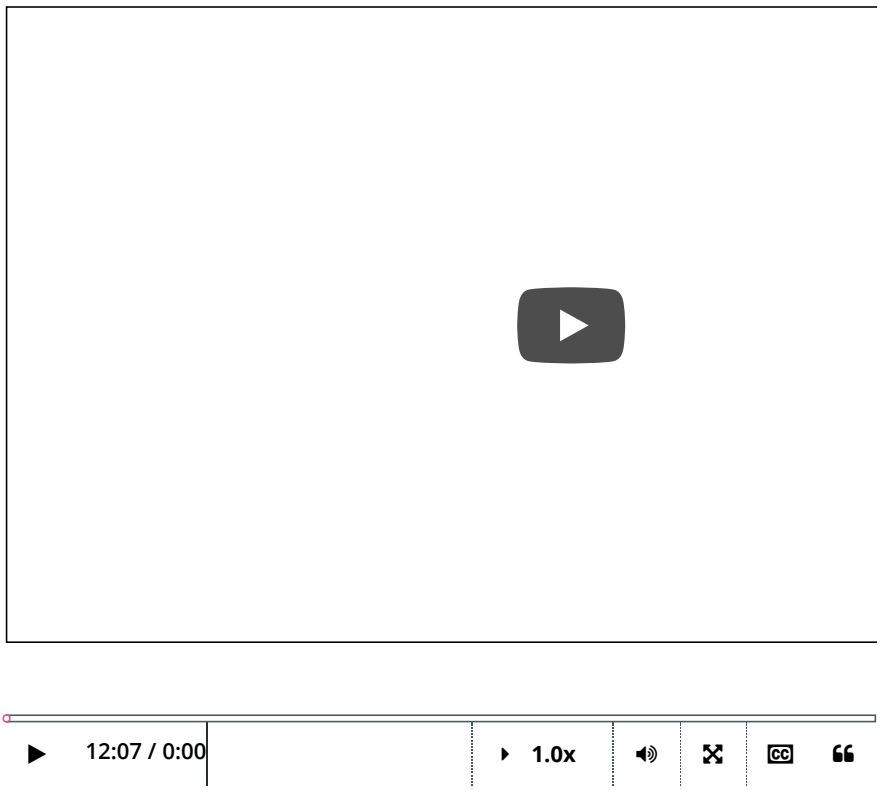
Random Variables
Video



Start of transcript. Skip to the end.

- Hello, and welcome back.

So, so far we have talked about distributions in general

and today we want to start talking about more specific

distributions, specifically about random variables.

Okay so we'll motivate random variables

we'll give some examples, a few definitions

and then we'll show how to visualize

7.1_Random_Variables

POLL
Which of the following statements is correct?

RESULTS

Random variables are mappings between outcomes and real numbers.	**49%**
Random variables are mappings between events and real numbers.	**33%**
Neither	**17%**

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Results gathered from 254 respondents.

FEEDBACK
Random variables are mappings between outcomes and real numbers.

1

0.0/3.0 points (graded)

For which value of α is the function $p_i = \frac{(\alpha+1)(i-\alpha)+2}{120}$ over $\{1, 2, \cdots, 10\}$ a p.m.f.?

9 ✖ **Answer:** 1.5

9

Explanation
The p.m.f should add up to 1, hence,

$$\sum_{i=1}^{10} p_i = \sum_{i=1}^{10} \frac{(\alpha+1)(i-\alpha)+2}{120} = \sum_{i=1}^{10} \frac{-\alpha^2+(i-1)\alpha+i+2}{120} = 1$$

.
This reduces to the quadratic equation $2\alpha^2 - 9\alpha + 9 = 0$ with two solutions $\alpha = \frac{3}{2}$ and $\alpha = 3$. Recall that $0 \leq p_i \leq 1$, the solution $\alpha = 3$ is discarded as some p_i's are negative, and we are left eith $\alpha = \frac{3}{2}$.

Submit You have used 4 of 4 attempts

Answers are displayed within the problem

2

0 points possible (ungraded)
Which of the following are true for random variables?

- [x] A random variable X defines an event.
- [x] For a random variable X and a fixed real number a, "$X \leq a$" defines an event. ✔
- [x] Random variables for the same sample space must be same.
- [x] For a random variable X, possible values for $P(X = x)$ include $0, 0.5$ and 1. ✔

✖

Explanation
Recall either the informal definition of a random variable as a real-valued random experiment, or the more formal one as a function that maps the sample set Ω to real numbers $\mathbb{R}$. Therefore:
- False. A random variable does not define an event.
- True. "$X \leq a$" is the set of outcomes that are at most a.
- False. A fair coin and a biased coin are two different variables with the same sample space \(\{h,t\}).
- True. $0 \leq P(X = x) \leq 1$, hence both $0, 0.5$ and 1 are possible.

Submit You have used 4 of 4 attempts

Answers are displayed within the problem

3

3/3 points (graded)

An urn contains 20 balls numbered 1 through 20. Three of the balls are selected from the run randomly without replacement, and X denotes the largest number selected.

- How many values can X take?

18 ✔ **Answer:** 18

18

Explanation

1 and 2 are impossible, the remaining 18 outcomes can occur.

- What is $P(X = 18)$?

0.119298245 ✔ **Answer:** 0.119

0.119298245

Explanation

18 is fixed, while the other 2 balls should selected from 1 to 17. $P(X = 18) = \binom{17}{2} / \binom{20}{3} = 0.119$

- What is $P(X \geq 17)$?

0.508771929 ✔ **Answer:** 0.508

0.508771929

Explanation

$$P(X \geq 17) = P(X = 17) + P(X = 18) + P(X = 19) + P(X = 20) = \frac{\binom{16}{2} + \binom{17}{2} + \binom{18}{2} + \binom{19}{2}}{\binom{20}{3}} = 0.508$$

.

Submit You have used 3 of 4 attempts

Answers are displayed within the problem

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