Expectation

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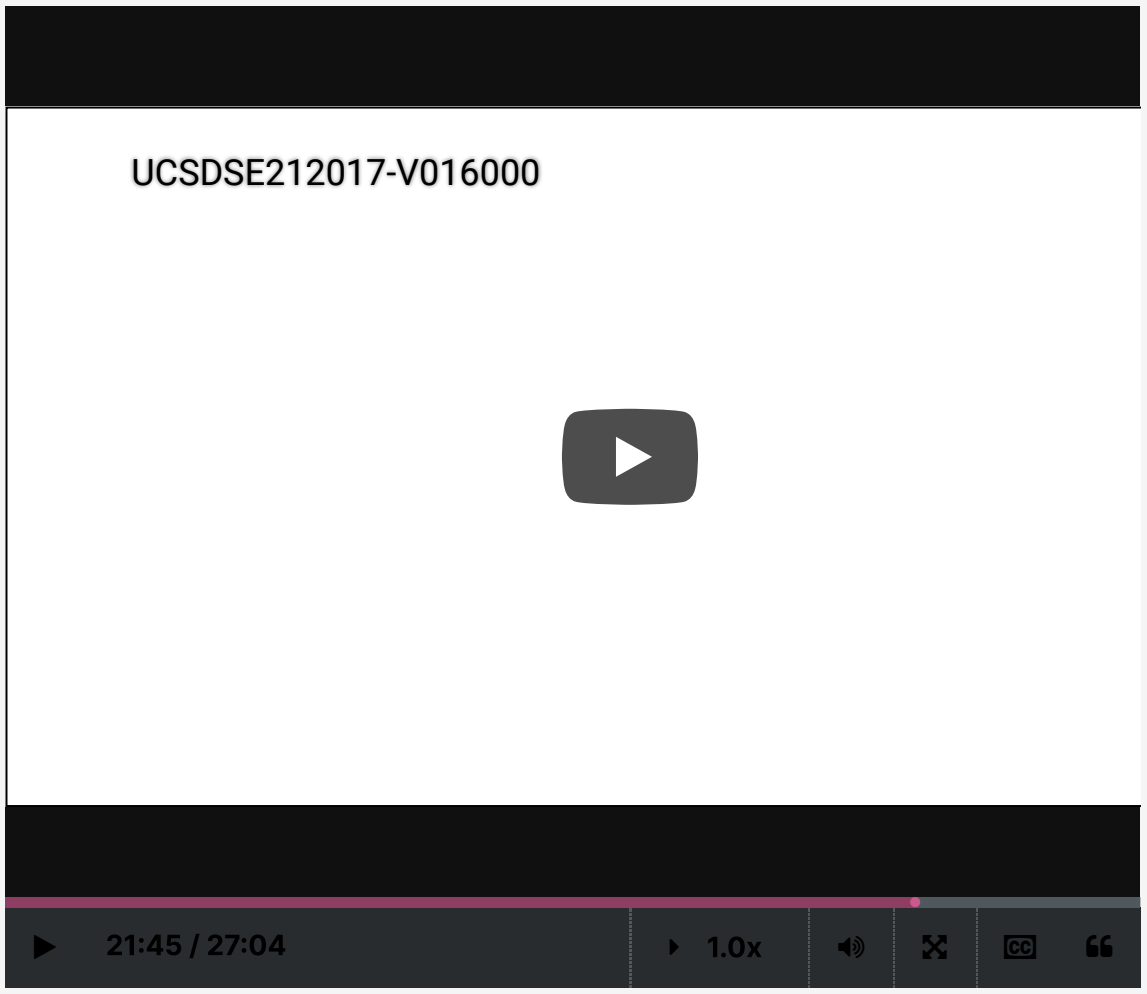
Problem Sets due Jul 8, 2022 16:34 +03 Completed

Video



Start of transcript. Skip to the end.

- Hello and welcome back.

In the last lecture we talked

about the cumulative distribution function

and now we would like to move on

and calculate expectations.

This picture and images that we'll get to

later on are taken from the Daily Mirror.

7.3_Expectation

POLL

The expectation of a random variable X must be a number X can take.

RESULTS

○	**True**	**20%**
◉	**Not true**	**80%**

Submit

Results gathered from 50 respondents.

FEEDBACK

The expectation of a die roll is 3.5.

1

0 points possible (ungraded)

Which 2 of the following are true about the expectation of a random variable?

- [x] Not random
- [ ] Random value
- [x] Property of the distribution
- [ ] Independent of the distribution

✔

Answer

Correct:
Video: Expectation
Video: Expectation
Video: Expectation
Video: Expectation

Explanation
An expectation of a distribution is a constant, which can be deducted by the distribution.

Submit You have used 3 of 4 attempts

Answers are displayed within the problem

2 (Graded)

2.0/2.0 points (graded)
A quiz-show contestant is presented with two questions, question 1 and question 2, and she can choose which question to answer first. If her initial answer is incorrect, she is not allowed to answer the other question. If the rewards for correctly answering question 1 and 2 are $200 and $100 respectively, and the contestant is 60% and 80% certain of answering question 1 and 2, which question should she answer first as to maximize the expected reward?

Question 2 ✔ **Answer:** Question 2

Explanation
The expected reward if Question 1 is answered first is given by
$300 \times 0.6 \times 0.8 + 200 \times 0.6 \times 0.2 + 0 = 168$,
and if Question 2 is chosen to be answered first,
$300 \times 0.8 \times 0.6 + 100 \times 0.8 \times 0.4 + 0 = 176$.
Thus she should choose to answer Question 2 first.

Submit You have used 1 of 1 attempt

Answers are displayed within the problem

3

0 points possible (ungraded)
If we draw cards from a 52-deck with replacement 100 times, how many times can we expect to draw a black king?

- ✔ 3.846
- 1.923
- 0.038
- 7.692

Answer
Correct: Video: Expectation

Explanation
Create 100 random variables $X_1, X_2, \cdots, X_{100}$, each of which is a binary number, with 1 denotes we get a black king and 0 otherwise. It is easy to show that $E[X_i] = \frac{2}{52}$.
The times we expect to draw a black king can be calculated using
$E[X_1 + X_2 + \cdots + X_{100}] = E[X_1] + E[X_2] + \cdots + E[X_{100}] = \frac{200}{52} = 3.846$.

Submit You have used 2 of 2 attempts

Answers are displayed within the problem

4 (Graded)

2.0/2.0 points (graded)

Each time you play a die rolling game you must pay $1. If you roll an even number, you win $2. If you roll an odd number, you lose additional $1. What is the expected value of your winnings?

- ◉ $-\$0.50$
- ○ $+\$0.50$
- ○ $+\$0.00$
- ○ $+\$1.00$
- ○ $-\$1.00$

✔

Answer

Correct: Video: Expectation

Explanation

Since each time you need to pay $1 for the game, the quesion is equivalent to "If you roll an even number, you win $1. If you roll an odd number, you lose $2."

With $P(\text{even}) = P(\text{odd}) = \frac{1}{2}$, the expetation is $1 \times \frac{1}{2} + (-2) \times \frac{1}{2} = -0.5$.

Submit You have used 1 of 2 attempts

Answers are displayed within the problem

5

0 points possible (ungraded)

Choose a random subset of $\{2^1, 2^2, \cdots, 2^{10}\}$ by selecting each of the 10 elements independently with probability $1/2$. Find the expected value of the smallest element in the subset (e.g. the subset can be $\{2^1, 2^3, 2^4, 2^7\}$. The smallest element is 2^1).

10 ✔ **Answer:** 10

10

Explanation

An element 2^j, $(j \in \{1, \cdots, 10\})$ is the smallest if and only if all elements less than it have not been chosen and j is chosen. The probability of this happening is $1/2^j$. Therefore the expectation is $\sum_{j=1}^{10} 1/2^j \cdot 2^j = 10.$

Submit You have used 1 of 4 attempts

Answers are displayed within the problem

6

0 points possible (ungraded)
An edX assignment has 50 multiple-choice questions, each with four choices of which one is correct. A student gets 3 points for solving a question correctly, and loses a point for an incorrect answer. What is the expected score of a student who answers all questions uniformly at random?

Submit You have used 0 of 4 attempts

7

0 points possible (ungraded)
Which of the following statements are true for a random variable X?

- [ ] $E(X)$ must be in the range $(0, 1)$
- [ ] $E(X)$ can take a value that X does not take
- [ ] $P(X \leq E(X)) = 1/2$
- [ ] $E(X) = \frac{1}{2}(x_{\max} + x_{\min})$

Submit You have used 0 of 4 attempts

8

0 points possible (ungraded)
A bag contains five balls numbered 1 to 5. Randomly draw two balls from the bag and let X denote the sum of the numbers.

- What is $P(X \leq 5)$?

- What is $E(X)$?

Submit You have used 0 of 4 attempts

9

0 points possible (ungraded)
A player flips two fair coins. The player wins $\$3$ if 2 heads occur and $\$1$ if 1 head occurs. How much money (in $\$$) should the player lose when no heads occur for the game to be fair (expected gain is 0)?

Submit You have used 0 of 4 attempts

10

0 points possible (ungraded)

There are 3 classes with 20, 22 and 25 students in each class for a total of 67 students. Choose one out of the 67 students uniformly at random, and let X denote the number of students in his or her class. What is $E(X)$?

Submit You have used 0 of 4 attempts

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