Two Variables

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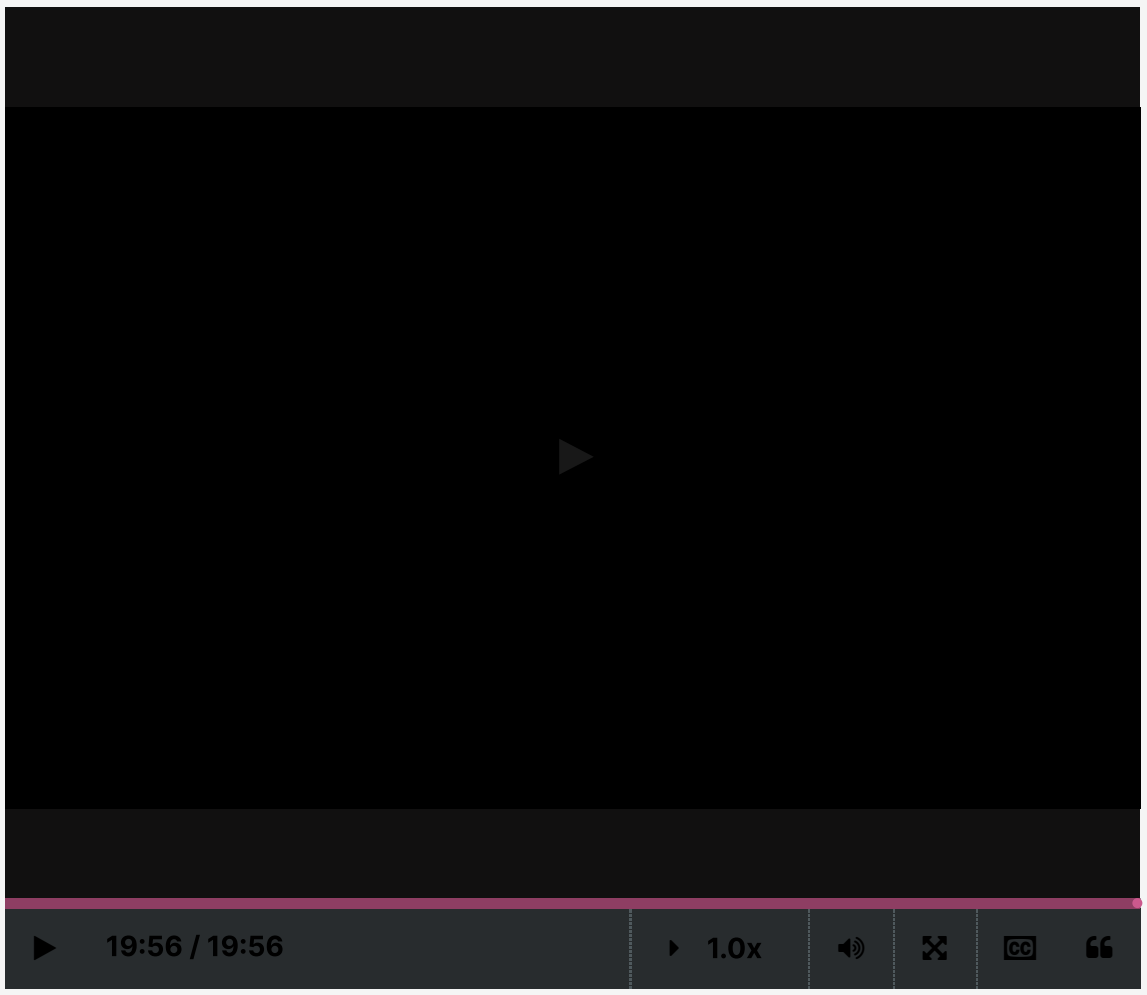
Problem Sets due Jul 8, 2022 16:34 +03

Video



they're not proportional to each other.

So with this we've introduced pairs of random variables

and in the next presentation,

we're going to start talking about expectation

of different functions of pairs of random variables.

See you then.

End of transcript. Skip to the start.

7.7a_Two_variables

POLL

If X has three different outcomes and Y has four different outcomes, how many outcomes does the joint random variable (X,Y) have?

RESULTS

4	**0%**
7	**4%**
12	**93%**
None of the above	**2%**

Submit

Results gathered from 45 respondents.

FEEDBACK

The answer is 3×4=12.

1

0 points possible (ungraded)

Which of the following hold for all **Independent** random variables, X and Y?

- [x] $P(X = x|Y = y) = P(X = x)$
- [ ] $P(X = x|Y = y) = P(Y = y|X = x)$

Explanation
If two random variables are independent, by definition, $P(X=x, Y=y) = P(X=x)\,P(Y=y)$. Since $P(X=x, Y=y) = P(X=x|Y=y)\,P(Y=y)$, we have $P(X=x|Y=y) = P(X=x)$.

Submit You have used 2 of 3 attempts

Answers are displayed within the problem

2 (Graded)

3/3 points (graded)
A joint probabilty mass table is given as follows:

$X\backslash Y$	0	1
0	0.15	0.25
1	0.45	0.15

1) Choose the correct marginal PMFs for X and Y.

x, y	$P(x)$	$P(y)$
0	0.15	0.45
1	0.25	0.5

x, y	$P(x)$	$P(y)$
0	0.4	0.6
1	0.6	0.4

x, y	$P(x)$	$P(y)$
0	0.6	0.4
1	0.4	0.6

Answer

Correct: Video: Two Variables

x, y	$P(x)$	$P(y)$
0	0.4	0.6
1	0.6	0.4

Explanaton
$P(X=0) = P(X=0, Y=0) + P(X=0, Y=1) = 0.15 + 0.25 = 0.4$
$P(X=1) = P(X=1, Y=0) + P(X=1, Y=1) = 0.45 + 0.15 = 0.6$
$P(Y=0) = P(Y=0, X=0) + P(Y=0, X=1) = 0.15 + 0.45 = 0.6$
$P(Y=1) = P(Y=1, X=0) + P(Y=1, X=1) = 0.25 + 0.15 = 0.4$

2) Find $P(X=0|Y=0)$.

- 0.250
- 0.375
- 0.667
- 1

Answer

Correct: Video: Two Variables

Explanaton

$P(X=0|Y=0)=\frac{P(X=0,Y=0)}{P(Y=0)}=\frac{0.15}{0.6}=0.25$

3) Find $P(Y=1|X=0)$.

- 0.375
- 0.417
- 0.625
- 0.750

Answer

Correct: Video: Two Variables

Explanaton

$P(Y=1|X=0)=\frac{P(X=0,Y=1)}{P(X=0)}=\frac{0.25}{0.4}=0.625$

Submit You have used 1 of 3 attempts

Answers are displayed within the problem

3

0 points possible (ungraded)

Given independent random variables X and Y with the following joint distribution. Find

$X \setminus Y$	0	1	sum
0	b	?	0.7
1	?	0.18	?
sum	a	?	

- a

0.4 **Answer:** 0.4

0.4

Explanation

$P(X=1)=1-P(X=0)=0.3$, $P(Y=1)=1-P(Y=0)=1-a$. By independence of X and Y, $P(X=1,Y=1)=0.18=P(X=1)\cdot P(Y=1)=0.3\cdot(1-a)$. Thus $a=0.4$.

- b

0.28 **Answer:** 0.28

0.28

Explanation

$b=P(X=0,Y=0)=P(X=0)\cdot P(Y=0)=P(X=0)\cdot a=0.7\times 0.4=0.28$.

Submit You have used 1 of 4 attempts

Answers are displayed within the problem

4

0 points possible (ungraded)

Which equation accurately describes the marginal PMFs for the random variables, X and Y?

- $P(X=x)=\sum_x p(X=x,Y=y), \quad P(Y=y)=\sum_y p(X=x,Y=y)$
- **(selected)** $P(X=x)=\sum_y p(X=x,Y=y), \quad P(Y=y)=\sum_x p(X=x,Y=y)$
- $P(X=x)=\sum_x p(Y=y), \quad P(Y=y)=\sum_y p(X=x)$
- $P(X=x)=\sum_y p(X=x), \quad P(Y=y)=\sum_x p(Y=y)$

✔

Answer

Correct: Video: Two Variables

Explanation

Refer to the video and slides.

Submit You have used 1 of 2 attempts

Answers are displayed within the problem

5 (Graded)

8/8 points (graded)

Roll two fair six-sided dice, and let X, Y denote the first and the second numbers.

If $Z=\max\{X,Y\}$, find

- $E(Z)$

161/36 ✔ **Answer:** 4.4722

$\frac{161}{36}$

Explanation

The distribution of Z is

$P(Z=1)=\frac{1}{36}, P(Z=2)=\frac{3}{36}, P(Z=3)=\frac{5}{36}, P(Z=4)=\frac{7}{36}, P(Z=5)=\frac{9}{36}, P(Z=6)=\frac{11}{36}$

The expectation of Z is $E(Z)=\sum_{i=1}^{6} i\cdot P(Z=i)=\frac{161}{36}=4.472$

- $V(Z)$

1.972 ✔ **Answer:** 1.9715

1.972

Explanation

$E(Z^2)=\sum_{i=1}^{6} i^2\cdot P(Z=i)=\frac{791}{36}$

The variance of Z is $V(Z)=E(Z^2)-E^2(Z)=1.9715$

If $Z=|X-Y|$, find

- $E(Z)$

70/36 ✔ **Answer:** 1.9444

$\frac{70}{36}$

Explanation

The distribution of Z is

$P(Z=0)=\frac{6}{36}, P(Z=1)=\frac{10}{36}, P(Z=2)=\frac{8}{36}, P(Z=3)=\frac{6}{36}, P(Z=4)=\frac{4}{36}, P(Z=5)=\frac{2}{36}$

The expectation of Z is $E(Z)=\sum_{i=0}^{5} i \cdot P(Z=i)=\frac{35}{18}=1.9444$

- $V(Z)$

2.0525 ✔ **Answer:** 2.0525

2.0525

Explanation

$E(Z^2)=\sum_{i=0}^{5} i^2 \cdot P(Z=i)=\frac{35}{6}$

The variance of Z is $V(Z)=E(Z^2)-E^2(Z)=2.0525$

? **Hint (1 of 1):** What is the PMF of Z (i.e. $P_Z(z)$)? Next Hint

Submit You have used 1 of 4 attempts

Answers are displayed within the problem

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