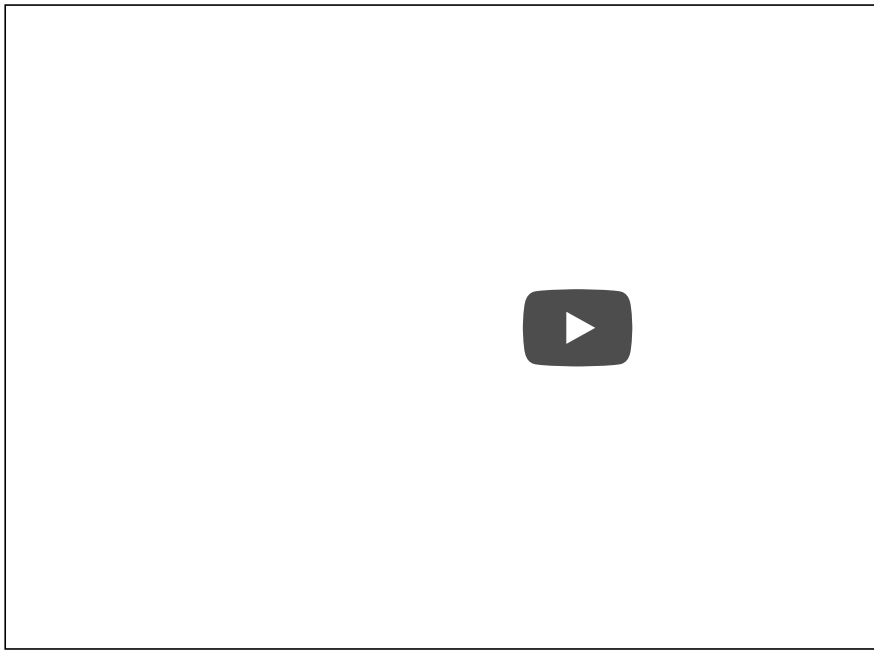
Two Variables
Video



10:10 / 0:00 1.0x

Start of transcript. Skip to the end.

- Hello again, everyone.

So far we've talked about single random variables

and it's to time to graduate to two.

So first, well we have a little bit of introduction,

why we're looking at two random variables.

Experiments often have multiple observations,

for example, if we are interested in the weather

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

12	**92%**
None of the above	**5%**
4	**2%**
7	**2%**

Submit

Results gathered from 199 respondents.

FEEDBACK
The answer is 3x4=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 1 of 3 attempts

Answers are displayed within the problem

2

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

5

✖ **Answer:** 0.4

5

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

✖ **Answer:** 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 4 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?

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

- ◉ $P(X=x)=\sum_y p(X=x,Y=y)\, P(Y=y)=\sum_x p(X=x,Y=y)$ ✔
- ○ $P(X=x)=\sum_x p(Y=y)\, P(Y=y)=\sum_y p(X=x)$
- ○ $P(X=x)=\sum_y p(X=x)\, P(Y=y)=\sum_x p(Y=y)$

Answer
Correct: Video: Two Variables

Explanation
Refer to the video and slides.

Submit You have used 1 of 2 attempts

ℹ Answers are displayed within the problem

5

2.0/8.0 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

- $E(Z)$

4.47 ✔ **Answer:** 4.4722

4.47

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

- $V(Z)$

✖ **Answer:** 1.9715

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

- $E(Z)$

4.13 ✖ **Answer:** 1.9444

4.13

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

- $V(Z)$

15.9349 ✖ **Answer:** 2.0525

15.9349

Explanation

$E(Z^2)=\sum_{i=0}^{5} i^2 \cdot P(Z=i)=\frac{35}{6}$
The variance of Z is $V(Z)=E(Z^2)-E^2(Z)=2.0525$

Submit You have used 4 of 4 attempts

Answers are displayed within the problem

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Topic: Topic 7 / Two Variables

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1