MITx: 14.310x Data Analysis for Social Scientists

Hel

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Question 13 - 20

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Question 13

1/1 point (graded)

Assume that the random variable X has a PDF given by $f_X(x) = 1 \text{ for } 0 < x < 1$. What is the PDF of the random variable $Y = X^2$?

○ a. $f_Y(y) = \sqrt{y} \text{ for } 0 < y < 1$

● b. $f_Y(y) = \frac{1}{2\sqrt{y}} \text{ for } 0 < y < 1$ ✓

○ c. $f_Y(y) = \frac{1}{2\sqrt{y}} \text{ for } -1 < y < 1$

○ d. $f_Y(y) = \frac{1}{2}y^{-\frac{3}{2}} \text{ for } -1 < y < 1$

Joint, Marginal, and Conditional Distributions
Finger Exercises due Oct 24, 2016 at 05:00 IST

Functions of Random Variables
Finger Exercises due Oct 24, 2016 at 05:00 IST

Module 4: Homework
Homework due Oct 17, 2016 at 05:00 IST

▸ Exit Survey

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Question 14

1/1 point (graded)

Suppose X has the geometric pmf $f_X(x) = \frac{1}{3}\left(\frac{2}{3}\right)^x$ for $x = 0, 1, 2, \cdots$. What is the probability distribution of $Y = \frac{X}{X+1}$, its pmf? *Note that both* X *and* Y *are discrete random variables.*

○ a. $f_Y(y) = \frac{1}{3}\left(\frac{2}{3}\right)^{\frac{y}{1-y}}$ for $y = 0, 1, 2, \cdots$

○ b. $f_Y(y) = \frac{1}{3}\left(\frac{2}{3}\right)^{\frac{1-y}{y}}$ for $y = 0, 1, 2, \cdots$

● c. $f_Y(y) = \frac{1}{3}\left(\frac{2}{3}\right)^{\frac{y}{1-y}}$ for $y = 0, \frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \cdots, \frac{x}{x+1}, \cdots$ ✓

○ d. $f_Y(y) = \frac{1}{3}\left(\frac{2}{3}\right)^{\frac{1-y}{y}}$ for $y = 0, \frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \cdots, \frac{x}{x+1}, \cdots$

Explanation

We have that:

$$Pr(Y=y)=Pr\left(\frac{X}{X+1}=y\right)=Pr\left(X=\frac{y}{1-y}\right)=\frac{1}{3}\left(\frac{2}{3}\right)^{\frac{1-y}{y}}$$

Since $x=0,1,2,\cdots$, then $y=0,\frac{1}{2},\frac{2}{3},\frac{3}{4},\cdots,\frac{x}{x+1},\cdots$

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✓ Correct (1/1 point)

Question 15

1/1 point (graded)

If the random variable X has a PDF given by $f_X(x)=\begin{cases}\frac{x-1}{2}, \text{ if } 1<x<3\\ 0 \text{ otherwise}\end{cases}$ then it is possible to find a monotone function $u(x)$ such that the random variable $u(X)$ has a uniform distribution between 0 and 1?

● Yes ✓

○ No

Explanation

From the lecture we know that if we use $u(x) = F_X(x) = \frac{(x-1)^2}{4}$ for $1 < x < 3$, then $Y = u(X)$ follows a uniform distribution between 0 and 1.

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✓ Correct (1/1 point)

Question 16

1 point possible (graded)

If we have N i.i.d random variables from the uniform distribution between 0 and 1, and we know that $N = 1$, what is the probability that the n^{th} order statistic is less than or equal to the value x

x^N

✗ **Answer:** x

Explanation

Since this is a random draw of just one number, then we know that $Pr(X_1^{(1)} \leq x) = x$.

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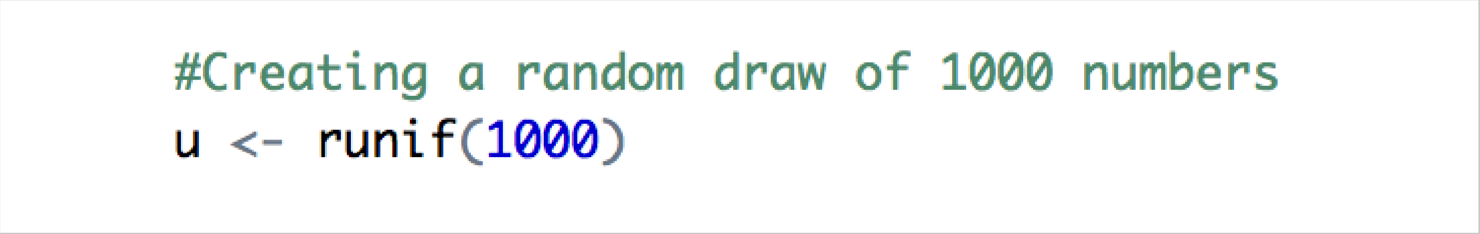
✗ Incorrect (0/1 point)

Question 17

1/1 point (graded)

The following code can be run in R to create a draw of 1000 numbers from the uniform distribution.



```
#Creating a random draw of 1000 numbers
u <- runif(1000)
```

Is it possible to create from this vector a random draw of a uniform distribution between 2 and 5?

● Yes ✓

○ No

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Question 18

1/1 point (graded)

What is the PDF of the minimum of the draw created in R?

○ a. It is given by $f_{y^{(1)}}(y) = 999(1-y)^{998}$

● b. t is given by $f_{y^{(1)}}(y) = 1000(1-y)^{999}$ ✓

○ c. It is given by $f_{y^{(1)}}(y) = 999(1-y)^{1000}$

○ d. It is given by $f_{y^{(1)}}(y) = 999y^{998}$

Explanation

In R, the code creates a vector of 1000 draws from the uniform distribution between 0 and 1. From the lecture we know that the minimum corresponds to the first order statistic and that it's PDF is given by: $f_{y^{(1)}}(y) = n(1-F_X(y))^{n-1}f_X(y)$. If we substitute for $n = 1000$ and $F_X(y) = y$ we obtain the answer.

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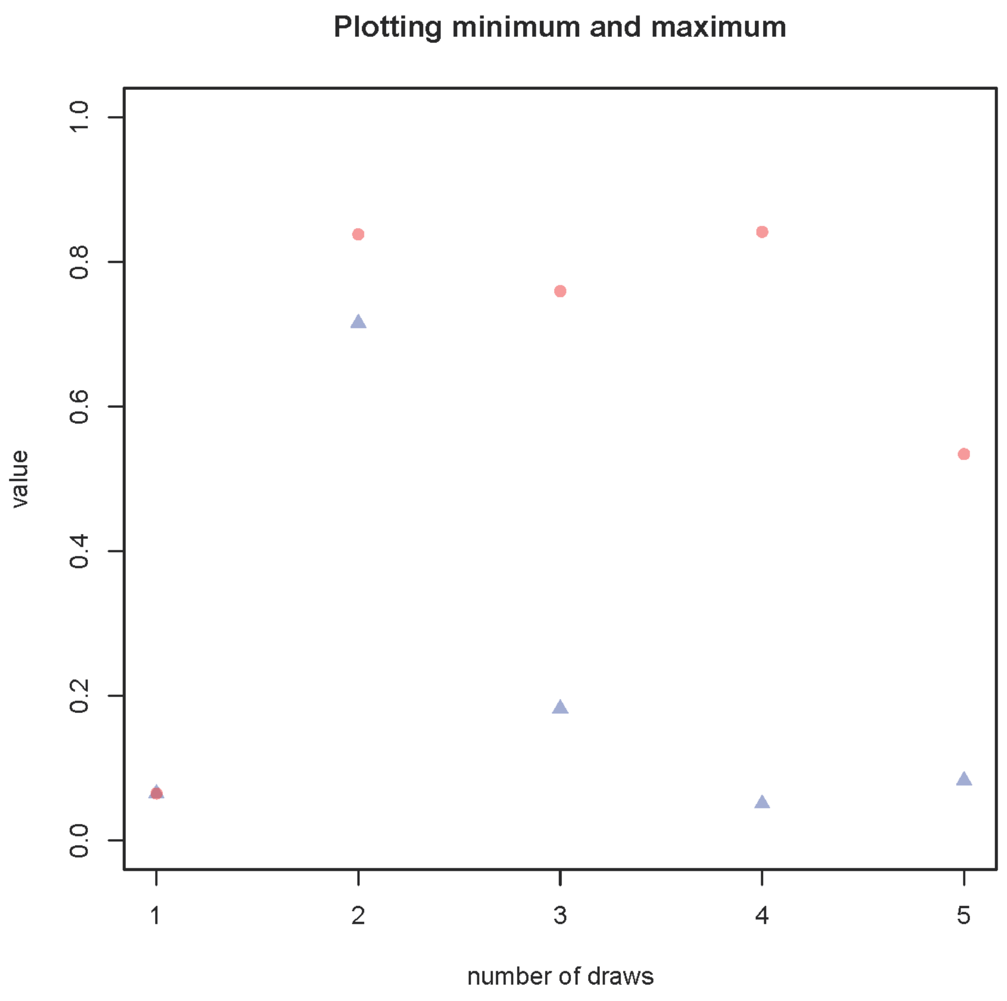
You have used 1 of 2 attempts

✓ Correct (1/1 point)

Question 19

1/1 point (graded)

The following plot shows the maximum and the minimum of a uniform distribution by changing the number of draws.



A student is claiming that this plot is wrong since both the maximum and the minimum should show a monotonous relationship with the number of draws. Is this student's statement **True or False**?

○ True

● False ✓

○ We can't tell

Explanation

The statement is false. Even though it is true that for the maximum it is more likely to have higher values when the number of draws increases, there is still a chance that this is not the case.

Submit You have used 1 of 1 attempts

✓ Correct (1/1 point)

Question 20

1/1 point (graded)

What is the command in R that allows you to transform this draw of random numbers into the one of a Standardized Normal distribution?

Please just enter the name of the command, without any parentheses or arguments.

qnorm ✓ **Answer:** qnorm

Explanation

The inverse of the CDF of the normal distribution in R is given by qnorm.

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✓ Correct (1/1 point)