

## Question 1

Not yet answered

Marked out of 5.00

This question requires that you show work. Work is 80% of your credit and involves showing intermediate steps. The rest is for labeling and defining things so that we know what they are, making clear what probabilities you are calculating and labeling them as such (are they conditional, total, etc..?) and providing your final number.

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Let  $X$  and  $Y$  denote random variables denoting the proportion of contaminants of type A and the proportion of contaminants of type B present in a landfill, respectively. A student calculated the conditional density function

$$f(y|x) = \frac{2(x+y)}{3x^2}, \quad 0 \leq y \leq x,$$

and the marginal density function

$$f(x) = 3x^2, \quad 0 \leq x \leq 1$$

Are  $x$  and  $y$  independent? Make sure that you justify your answer with detailed work.

**You may attach a file with work. But the file must contain only the answer to this question. If it contains answers for other questions, those questions will not be graded at all. You may not email your work to this question. It will not count that way. Alternatively, it would be best if you could use the editor and solve your math work using the equation editor in it, which you can see by clicking on the arrow in the menu and selecting the calculator icon.**



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## Question 2

Not yet answered

Marked out of 3.00

This question requires that you show work. Work is 80% of your credit and involves showing intermediate steps. The rest is for labeling and defining things so that we know what they are, making clear what probabilities you are calculating and labeling them as such (are they conditional, total, etc..?) and providing your final number.

**You may not attach a file to this question. Answer in the space provided. Only the work written in the space provided below will be read.** The editor has a table capability that will help you do nice tables. To expand the options in the editor, click on the arrow above in the menu to expand it, and choose the table option.

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Three randomly chosen students from UCLA are interviewed to determine their attitude towards changing from the current quarter system to a semester system. Let the random variable  $X$  denote the response, with  $X = 1$  denote the answer "YES" (move to a semester system) and  $X = 0$  denote "NO" (do not move to a semester system). The probability that a randomly chosen UCLA student votes yes has been estimated by students in this class in another quarter to be approximately 0.45.

- List the sample space of the experiment consisting of observing the choice of three randomly chosen students to the question and calculate the probability of each single outcome in it, indicating the rules of probability and assumptions you are making.
- Write a table with the joint probability mass function of random variables  $X$  and  $Y$ , where  $Y$  denotes the number of students in the random sample of 3 students that are in favor of switching to the semester system.
- Determine and show whether  $X$  and  $Y$  are independent, using the definition of independence and also comparing the marginal distribution of  $Y$  with the conditional distributions of  $Y$  for given values of  $X$ .



## Question 3

Not yet answered

Marked out of 1.00

We have two conditional distributions below:

y	P(Y=y X=0)
0	$\frac{P(Y=0 X=0)}{P(X=0, Y=0)} = \frac{0.012}{0.3} = 0.04$
1	$\frac{P(Y=1 X=0)}{P(X=0, Y=1)} = \frac{0.096}{0.3} = 0.32$
2	$\frac{P(Y=2 X=0)}{P(X=0, Y=2)} = \frac{0.192}{0.3} = 0.64$
3	$\frac{P(Y=3 X=0)}{P(X=0, Y=3)} = \frac{0}{0.3} = 0$

y	P(Y=y X=1)
0	$\frac{P(Y=0 X=1)}{P(X=1, Y=0)} = \frac{0}{0.7} = 0$
1	$\frac{P(Y=1 X=1)}{P(X=1, Y=1)} = \frac{0.028}{0.7} = 0.04$
2	$\frac{P(Y=2 X=1)}{P(X=1, Y=2)} = \frac{0.224}{0.7} = 0.32$
3	$\frac{P(Y=3 X=1)}{P(X=1, Y=3)} = \frac{0.448}{0.7} = 0.64$

The two random variables X and Y are

- ☐ a. complement of each other
- ☐ b. not independent
- ☐ c. mutually exclusive
- ☐ d. independent

## Question 4

Not yet answered

Marked out of 1.00

*Office hours videos, supplementary lectures, module week 6.*

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The distribution of blood types in a certain country are such that 25% of the population are type O, 55% are type A, 20% are type B. Suppose that 30 people are selected at random from this country. What is the probability that 10 are type O, 10 are type A, and the other 10 are type B?

- ☐ a. 0.999
- ☐ b. 0.7814
- ☐ c. 0.33145
- ☐ d. 0.001373087

## Question 5

Not yet answered

Marked out of 1.00

The random variable  $Y$  can take values 1 or 4, and the random variable  $X$  can take values  $-1, -2, 1, 2$ .  
The joint probability mass function of  $X$  and  $Y$ ,  $P(X, Y)$ , appears below.

		Y	
		<b>1</b>	<b>4</b>
	<b>-2</b>	0	1/4
X	<b>-1</b>	1/4	0
	<b>1</b>	1/4	0
	<b>2</b>	0	1/4

Select all that applies

Select one or more:

- ☐ a.  $X, Y$  are two independent random variables.
- ☐ b.  $E(X) = 0$
- ☐ c.  $X, Y$  are not two independent random variables.
- ☐ d.  $Var(X) = 1$

## Question 6

Not yet answered

Marked out of 1.00

A small college is offering two meal plans for the undergraduate students in the dorms, plan A and plan B.  
Let X and Y have the joint density function

$$f(x, y) = 2(x + y) \quad 0 < y < x < 1,$$

where X is the proportion of students purchasing plan X and Y is the number of students purchasing plan B.  
If 10% of the students purchase plan A, what is the probability that less than 5% buy plan B?

Select one:

- ☐ a. 0.013
- ☐ b. 0.010
- ☐ c. 0.5
- ☐ d. 0.4167

## Question 7

Not yet answered

Marked out of 1.00

The conditional probability density function of random variable  $Y$  when  $X$  is 0 is given by

$y$	$P(Y=y X=0)$
0	0.04
1	0.32
2	0.64
3	0

and the unconditional probability mass function of  $X$  is

$x$	$P(X=x)$
0	0.3
1	0.7

Then the joint probability  $P(Y=1, X=0)$  is equal to

- ☐ a. 0.096
- ☐ b. 0.89
- ☐ c. 0.124
- ☐ d. 0.028

## Question 8

Not yet answered

Marked out of 3.00

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Suppose we have a set of independent and identically distributed continuous random variables  $x_1, x_2, \dots, x_n$ , each of them with the density given below. We would like to find the joint density function of these  $n$  random variables.

$$f(x) = \frac{\gamma}{\alpha} \left( \frac{x-\mu}{\alpha} \right)^{(\gamma-1)} \exp(-(x-\mu)/\alpha)^\gamma \quad x \geq \mu; \gamma, \alpha > 0$$

(a) Showing detailed intermediate work, provide a final formula where you have simplified the final expression as much as possible, as done in the pre-recorded lecture videos.

(b) Where in past modules, in pre-recorded lectures before module 6, did we use a joint density to solve a statistical estimation problem? Describe what problem that was.

(c) When we say that  $x_1, x_2, \dots, x_n$  are independent identically distributed, are we saying that all of those  $x_i$  have the same value? Use a random variable that applies to students at UCLA, a continuous random variable to explain.

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## Question 9

Not yet answered

Marked out of 1.00

Let  $X$  be a random variable with density function

$$f(x, y) = 2, \quad 0 \leq y \leq x \leq 1$$

Which of the following is the marginal probability density function of  $X$ ?

Select one:

☐ a.

$$f(x) = 2x^2, \quad 0 \leq x \leq 1$$

☐ b.

$$f(x) = 2x, \quad 0 \leq x \leq 1$$

☐ c.

$$f(x) = 2x, \quad y \leq x \leq 1$$

☐ d.

$$f(x) = 2xy, \quad y \leq x \leq 1$$

## Question 10

Not yet answered

Marked out of 1.00

When we talk about the joint density function of two random variables,  $X, Y$ ,  $(f(x,y))$ , for constants  $a$  and  $b$ ,

$$P(X \leq a, Y \geq b)$$

is

Select one:

- ☐ a. always 1 to satisfy axioms
- ☐ b. an area
- ☐ c. the value of the first quartile
- ☐ d. a volume