

Discussion Section #9**Due: To be submitted to CatCourses by 11:59pm.****Instructions:**

This week you will review fundamental properties from Probability and Statistics.

You are allowed to work alone or in small groups. But if you work in a group, the work you turn in should be your own. Each student will submit a physical write-up as a PDF document to CatCourses **by the end of your Discussion section**.

Providing the correct answer, without justification, is not considered complete. For credit you **must** either show your steps (if it's a calculation problem) or explain/justify your reasoning (if it's a short answer problem).

Problem Set:

1. (2 Points, 0.5 Points per Part). If A and B are mutually exclusive events in a sample space Ω with an associated probability P . Suppose that $P(A) = 0.2$ and $P(B) = 0.3$. For each of the statements below, decide if they are **true**, **false** or **unknown** and explain your reasoning. For full credit you need both answer correctly and have correct reasoning.

Remember:

- $A \cap B$ are the set of all outcomes in Ω in **both** A **and** B .
- $A \cup B$ are the set of all outcomes in Ω belonging to **either** A **or** B .

- (a) $P(A \cap B) = 0$.
(b) $P(A|B) = 0$.
(c) $P(A \cup B) = 0.4$.
(d) A and B are independent.

2. (3 Points). Consider the following joint probability mass function for random variables X and Y :

	X		
	$X = 0$	$X = 1$	$X = 2$
$Y = -1$	0.25	0.25	0
$Y = 1$	0.15	0.10	α

- (a) (0.5 Point). Determine the value of α .
(b) (1 Point). Determine the marginal distribution of X and Y .
(c) (1 Point). What is the correlation between X and Y ?
(d) (0.5 Points). Are X and Y independent?

3. (2 Points.) In a certain city, suppose that 60% of the population subscribe to newspaper A , 50% subscribe to newspaper B , 40% to newspaper C . Of course, some of those individuals actually subscribe to more than 1 newspaper. Suppose that 30% subscribe to both newspaper A and B , 20% to both newspaper B and C and 10% to both A and C . Finally, suppose that no one in the city subscribes to A , B and C . (I mean, who needs 3 newspapers?)

(Hint: You might find it helpful to look back to Problem #1 from Homework Assignment #3.)

- (a) What percentage of people subscribe to exactly one of these three newspaper?
- (b) What percentage of people subscribe to none of the these newspapers?

4. (3 Points.) Suppose X and Y are jointly distributed random variables with probability density function

$$f(x, y) = \begin{cases} K(x^2 + 6y) & 0 \leq x \leq 1 \text{ and } 0 \leq y \leq x \\ 0 & \text{otherwise} \end{cases}.$$

- (a) (1 Points). Find the value for the constant K
- (b) (1 Point). Determine the marginal distributions of X and Y . (Be careful with your bounds of integration! Double check that you get a true PDF for each marginal!)
- (c) (1 Point). Determine if X and Y are independent. (Try to give a solution that does not depend on the calculation you previously performed.)