1
point

1.
Which of the following (possibly more than one) must be true if random variable X is continuous with PDF $f(x)$?

- [ ] $\int_{-\infty}^{\infty} f(x)dx = 1$
- [ ] $f(x) \geq 0$ always
- [ ] $f(x)$ is a continuous function
- [ ] $\lim_{x\to\infty} f(x) = \infty$
- [ ] $f(x)$ is an increasing function of x
- [ ] $X >= 0$ always

1
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2.
If $X \sim \text{Exp}(3)$, what is the value of $P(X > 1/3)$? Round your answer to two decimal places.

Enter answer here

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point

3.
Suppose $X \sim \text{Uniform}(0, 2)$ and $Y \sim \text{Uniform}(8, 10)$. What is the value of $E(4X + Y)$?

Enter answer here

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4.
For Questions 4-7, consider the following:

Suppose $X \sim \mathrm{N}(1, 5^2)$ and $Y \sim \mathrm{N}(-2, 3^2)$ and that X and Y are independent. We have $Z = X + Y \sim \mathrm{N}(\mu, \sigma^2)$ because the sum of normal random variables also follows a normal distribution.

- What is the value of μ?

Enter answer here

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5.
Adding normals:

- What is the value of σ^2?

Hint: If two random variables are independent, the variance of their sum is the sum of their variances.

Enter answer here

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6.

Adding normals:

If random variables X and Y are not independent, we still have $E(X+Y) = E(X) + E(Y)$, but now $Var(X+Y) = Var(X) + Var(Y) + 2Cov(X,Y)$ where $Cov(X,Y) = E[(X - E[X])(Y - E[Y])]$ is called the covariance between X and Y.

- A convenient formula for calculating variance was given in the supplementary material: $Var(X) = E[(X - E[X])^2] = E[X^2] - (E[X])^2$. Which of the following is an analogous expression for the covariance of X and Y?

Hint: Expand the terms inside the expectation in the definition of $Cov(X,Y)$ and recall that $E(X)$ and $E(Y)$ are just constants.

- $E[Y^2] - (E[Y])^2$
- $(E[X^2] - (E[X])^2) \cdot (E[Y^2] - (E[Y])^2)$
- $E(XY) - E(X)E(Y)$
- $E[X^2] - (E[X])^2 + E[Y^2] - (E[Y])^2$

1
point

7.
Adding normals:

- Consider again $X \sim \mathrm{N}(1, 5^2)$ and $Y \sim \mathrm{N}(-2, 3^2)$, but this time X and Y are *not* independent. Then $Z = X + Y$ is still normally distributed with the same mean found in Question 4. What is the variance of Z if $E(XY) = -5$?

Hint: Use the formulas introduced in Question 6.

Enter answer here

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point

8.

Free point:

1) Use the definition of conditional probability to show that for events A and B, we have $P(A \cap B) = P(B|A)P(A) = P(A|B)P(B)$.

2) Show that the two expressions for independence $P(A|B) = P(A)$ and $P(A \cap B) = P(A)P(B)$ are equivalent.

- [ ] Solution (1)
- [ ] Solution (2)

- [ ] I, **Md Yousuf Ali**, understand that submitting work that isn't my own may result in permanent failure of this course or deactivation of my Coursera account.

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