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Module 5 Quiz

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$P(X) = 10X - (10-X)5 = 10X - 50 + 5X$
$= 15X - 50$

1. **Prompt 1:** A store orders 10 units of a certain item. For each unit sold, it makes $\$10$. For each item that remains unsold, it loses $\$5$. Let X be the number of items sold in a week. If the store knows that X is a discrete uniform random variable, with X taking values $\{0, 1, \ldots, 10\}$, find the expected profit. **1 / 1 point**

Uniform:
$E(X) = \frac{a+b}{2} = \frac{0+10}{2}$
$= 5$

$E(P) = E(15X - 50) = 15E(X) - 50$
$= 15 \cdot 5 - 50 = 25$

25

Correct

$\mu = 10 \quad \lambda = 0.1$

2. **Prompt 2:** Suppose that the service time at a call center is exponentially distributed with the average call lasting 10 minutes. If 3 workers are each on a call, what is the probability that they have each completed their service in 12 minutes? Assume that the length of each call is independent of every other call. Round answer to four decimal places. **1 / 1 point**

$P(X < 12) = pexp(12, 0.1)$

$P(X<12)^3 = pexp(12, 0.1) =$
0.3412

0.3412

Correct

3.

	y=1	y = 4	y = 16	
x=1	0.20	0.25	0.05	0.5
x=5	0.10	0.15	0.25	0.5
	0.3	0.4	0.3	

1 / 1 point

Prompt 3: Suppose that X and Y are random variables with the joint probability mass function above.

Find $P(X = 1)$.

0.5

Correct

$P(X=5, Y=1) + P(X=5, Y=4)$
$= 0.1 + 0.15 = 0.25$

4. **Prompt 3:** Suppose that X and Y are random variables with the joint probability mass function below. **1 / 1 point**

	y=1	y = 4	y = 16
x=1	0.20	0.25	0.05
x=5	0.10	0.15	0.25

Find $P(X > Y)$.

0.25

Correct

$Cov(X, Y) = E(XY) - E(X)E(Y)$

$E(X) = 1 \times 0.5 + 5 \times 0.5$
$= 3$

$E(Y) = 1 \times 0.3 + 4 \times 0.4 + 16 \times 0.3$
$= 6.7$

$E(XY) = 1 \times 1 \times 0.2 + 1 \times 4 \times 0.25 + 1 \times 16 \times 0.05 +$
$5 \times 1 \times 0.1 + 5 \times 4 \times 0.15 + 5 \times 16 \times 0.25$
$= 25.5$

$25.5 - 3 \times 6.7$
$= 5.4$

5. **Prompt 3:** Suppose that X and Y are random variables with the joint probability mass function below. **1 / 1 point**

	y=1	y = 4	y = 16	
x=1	0.20	0.25	0.05	0.5
x=5	0.10	0.15	0.25	0.5
	0.3	0.4	0.3	

Determine $Cov(X, Y)$.

5.4

Correct

$\rho_{X,Y} = \frac{Cov(X,Y)}{\sigma_X \sigma_Y}$

$= \frac{5.4}{\sqrt{4} \cdot \sqrt{38.61}}$
$= 0.4345$

$E(X^2) = 1^2 \times 0.5 + 5^2 \times 0.5$
$= 13$

$E(Y^2) = 1^2 \times 0.3 + 4^2 \times 0.4 + 16^2 \times 0.3$
$= 83.5$

$V(X) = E(X^2) - E(X)^2 = 13 - 9 = 4$

$V(Y) = E(Y^2) - E(Y)^2 = 83.5 - 6.7^2 = 38.61$

6. **Prompt 3:** Suppose that X and Y are random variables with the joint probability mass function below. **1 / 1 point**

	y=1	y = 4	y = 16
x=1	0.20	0.25	0.05
x=5	0.10	0.15	0.25

Find ρ, the correlation coefficient of X and Y. Round answer to four decimal places.

0.4345

Correct

7. **Prompt 3:** Suppose that X and Y are random variables with the joint probability mass function above. **1 / 1 point**

	y=1	y = 4	y = 16

x=1	0.20	0.25	0.05
x=5	0.10	0.15	0.25

Are X and Y independent? (Answer "Yes", "No", or "Can't determine")

No

Correct

$Cov(X,Y) = 5.4 > 0$

Not independent.

$$f(k) = \frac{\lambda^k}{k!} \cdot e^{-\lambda}$$

$$f(x) = \lambda e^{-\lambda x}$$