q4

Quiz 4: Probability Review

Started: Oct 8 at 5:48am

Quiz Instructions

Question 1 — 1 pts

Which of the following is not always true for a discrete random variable X?

- $\mathbb{E}[cX] = c\mathbb{E}[X]$
- if $X \geq 0$ then $\mathbb{E}[X] \geq 0$
- ✓ $\mathbb{E}[XY] = \mathbb{E}[X]\,\mathbb{E}[Y]$
- $\mathbb{E}[X+Y] = \mathbb{E}[X] + \mathbb{E}[Y]$

Question 2 — 1 pts

Consider the following PMFs

X	$P(X)$	$Q(X)$
1	1/2	1/4
2	1/4	1/2
3	1/4	1/4

Calculate $D_{KL}(P\|Q) - D_{KL}(Q\|P)$

Use $\log_2$ when calculating D_{KL}

- ✓ 0
- $-1/2$
- $3/4$
- 1/2

Question 3 — 1 pts

Consider a random variable X which takes on the values −1, 0 and 1 with probabilities P(−1)=1/4, P(0) = 1/2, P(1) = 1/4. Find the entropy H(X), in base 2.

- -0.75
- ✓ 1.5
- 0.75
- 1

Question 4 — 1 pts

A bag contains 5 blue balls and 10 white balls. A ball is drawn from the bag and its color is noted. Then this ball is put back into the bag with 3 more balls of the same color. A ball is then drawn again from the bag at random. The probability that the first ball drawn is blue, given that the second ball drawn is blue, is:

- ✓ 4/9
- 1/3
- 8/9
- 3/4

Question 5 — 1 pts

We have two machines A and B, which work independently. The probability that machine A breaks down is 0.1 and the probability that machine B breaks down is 0.2. We build a production line from these machines, where the output of machine A is fed into machine B as input. What is the probability that our production line stops working (i.e.: no output can be produced because either machine breaks down)?

- 0.2
- 0.1
- 0.72
- ✓ 0.28

Question 6 — 1 pts

There are 67 students in a class, 32 of whom earned A+ on assignment 1, 10 of whom earned A+ on assignment 2, and 27 of whom did not earn A+ on either of them. What is the probability that a randomly selected student from the class earned A+'s on both assignments 1 and 2?

- 40/67
- 4/67
- ✓ 2/67
- 42/67

Question 7 — 1 pts

Which of the following statement is true?

- if X and Y are independent random variables, then $Cov(X,Y) \neq 0$.
- If $Cov(X,Y) = 0$, then X and Y are necessarily independent random variables.
- $Cov(X,Y) = 0$, if and only if X and Y are independent random variables.
- ✓ X and Y are independent random variables, then $Cov(X,Y) = 0$.

Question 8 — 1 pts

Let X be a continuous random variable, with PDF:

$$f_X(x) = \begin{cases} 0 & x < 0 \\ 0.5 & 0 \leq x < 1 \\ e^{-x} & x \geq 1 \end{cases}$$

What is the conditional expectation of X, given $X < 1$?

- 1
- 0
- ✓ 0.5
- e^{-x}

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