

KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS
ELECTRICAL ENGINEERING DEPARTMENT

SPRING 2010 (102)

EE 315 Probabilistic Methods in Electrical Engineering

QUIZ #1

Name:

ID:

Q1. Consider the experiment of throwing a die. We have the following probability assignments

$$P(\{1, 2, 3, 4\}) = 0.7; \quad P(\{5, 6\}) = 0.4; \quad P(\{2, 4\}) = 0.2; \quad P(\{2, 4, 5, 6\}) = 0.7.$$

Which probability axioms are not satisfied in this case?

1. The first axiom is satisfied ($P(A) \geq 0$)
2. The axiom $P(S) = 1$ is not because $P(\{5, 6\} \cup \{1, 2, 3, 4\}) = 0.4 + 0.7 = 1.1 \neq 1$
3. The 3rd axiom is not satisfied because $\{5, 6\}$ & $\{2, 4\}$ are mutually exclusive & yet $P(\{2, 4\} \cup \{5, 6\}) = P\{2, 4, 5, 6\} = 0.7 \neq P\{2, 4\} + P\{5, 6\}$

Q2. An experiment consists of tossing (throwing) a fair coin 3 times. Answer the following questions

a) Write down the sample space. How many elements does it contain?

① $S = \{HHH, HHT, HTH, HTT, TTH, THT, TTH, TTT\}$

① The sample space contains 8 elements

b) What is the probability of having of having two heads followed by a tail?

② $P(HHT) = 1/8$

c) What is the probability of having the same side in two consecutive throws (an example is (H, H, T) or (H, T, T)).

Same side in consecutive throws is the following set

$A = \{HHH, HHT, HTH, TTH, THT, TTT\}$

② for getting set correctly.

④ $P(A) = \frac{6}{8} = \frac{3}{4}$

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d) What is the probability that the last throw is a tail given that the first is a tail.

Let A = set of outcomes where last throw is tail (1)
 $= \{HHT, HTT, THT, TTT\}$

B = first is a tail (1)
 $= \{THH, THT, TTH, TTT\} \Rightarrow P(B) = 4/8 = 1/2$

$$\text{Then } P(A|B) = \frac{P(A \cap B)}{P(B)} = \frac{P(\{THT, TTT\})}{4/8} = \frac{2/8}{4/8} = \frac{2}{4} = 1/2 \quad (1)$$

Q3. A box contains 5 green balls and 10 yellow balls. W

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a) What is the probability that the first ball is yellow and the second is green.

Let Y_1 be event that first is yellow
 G_2 " " " 2nd is Green

$$P(Y_1 \cap G_2) = P(G_2|Y_1) P(Y_1) \quad (2)$$

$$= \frac{5}{14} \cdot \frac{10}{15} \quad (2)$$

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b) What is probability that the two balls drawn have the same color?

Let Y_i be the event that the i th ball is yellow ($i=1,2$)
 G_i " " " " " " Green ($i=1,2$)

$$P(\text{Two balls of same color}) = P((Y_1 \cap Y_2) \cup (G_1 \cap G_2)) \quad (3)$$

$$= P(Y_1 \cap Y_2) + P(G_1 \cap G_2) \quad (2)$$

$$= P(Y_2|Y_1) P(Y_1) + P(G_2|G_1) P(G_1) \quad (2)$$

$$= \frac{9}{14} \cdot \frac{10}{15} + \frac{4}{14} \cdot \frac{5}{15} \quad (1)$$

$$= \frac{110}{14 \times 15}$$

because $Y_1 \cap Y_2$ and $G_1 \cap G_2$ are mutually exclusive