Assignment 1A: Introduction to Bayesian Statistics

Q1 (5 points)

There are two events A and B. P (A) = .5 and P (B) = .3. The events A and B are independent.

a. Find P(A')
b. Find P(A $\cap$ B)
c. Find P(A $\cup$ B)

Ans:

Q2 (6 points)

Two fair dice, one red and one green, are rolled. Let the event A be "the sum of the faces showing is equal to seven". Let the event B be "the faces showing on the two dice are equal".

a. List out the sample space of the experiment.
b. List the outcomes in A, and find P (A).
c. List the outcomes in B, and find P (B).
d. List the outcomes in (A $\cap$ B), and find P (A $\cap$ B).
e. Are the events in A and B independent? Explain why or why not.
f. How would you describe the relationship between event A and event B?

Ans:

Q3 (4 points)

Suppose there is a medical screening procedure for a specific cancer that has sensitivity = 0.90, and specificity =0.95. Suppose the underlying rate of the cancer in the population is 0.001. Let B be the event "the person has that specific cancer," and let A be the event "the screening procedure gives a positive result."

a. What is the probability that a person has the disease given the results of the screening is positive?
b. Does this show that screening is effective in detecting this cancer?

Ans:

Q4 (6 points)

A. You are playing blackjack with a newly shuffled deck that consists of four decks of 52 cards each shuffled together. You have been dealt a ten and a six. The dealer has been dealt a jack face up, and another card face down. If you ask to be dealt another card, what is the probability you do not get "busted"

B. Suppose the deck isn't being shuffled between every hand played. The cards from previous hands are in the discard pile. In the previous hands you have observed 4 cards that are five or below, and 20 cards that are over five. On this hand you have been dealt a ten and a six. The dealer has been dealt a jack face up, and another card face down. If you ask to be dealt another card, what is the probability you do not get "busted"

Ans:

Q5 (6 points)

A discrete random variable Y has discrete distribution given in the table on page 97 of the Second Edition (page 92 of the First Edition) of the text.(see exercise 5.2 in the text)

a. Calculate P ($0 < Y < 2$).
b. Calculate E(Y).
c. Calculate Var(Y).
d. Let $W = 3Y - 1$. Calculate E (W).
e. Calculate Var (W).

Ans:

Q6 (4 points)

Let Y have the Poisson ($\mu=3$) distribution.

a. Calculate $P(Y = 3)$
b. Calculate $P(Y \leq 3)$
c. Calculate $P(1 \leq Y < 5)$

Ans:

Q7 (5 points)

Let X have a beta (12, 4) distribution.

a. Find E(X).
b. Find Var(X).

Ans:

Q8 (4 points)

Let Z have the standard normal distribution.

a. Find P ($0 \leq Z \leq 1.52$).
b. Find P ($Z \geq 2.11$).
c. Find P ($-1.45 \leq Z \leq 1.74$).

Ans:

Q9 (3 points)

Let Y be normally distributed with mean $\mu = 860$ and variance $\sigma^2 = 576$.

a. Find P($Y \leq 900$).
b. Find P($Y \geq 825$).
c. Find P ($840 \leq Y \leq 890$).

Ans:

Q10 (5 points)

Let Y be distributed according to the beta (15, 10) distribution.

a. Find E(Y).
b. Find Var(Y).
c. Find P($Y < .5$) using the normal approximation

Ans:

Q11 (5 points)

Let Y be distributed according to the gamma (26,5) distribution.

a. Find E(Y).
b. Find Var(Y).
c. Find P($Y > 5$).

Ans:

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