Quiz Week 2 - Probability - Questions

FIT5197 teaching team

Question 1

What is the probability of getting a numeric total of 4 or 6 from rolling two fair/unbiased dice?

Question 2

Draw 5 cards from a deck of 52 cards (no jokers) without replacement, what is the probability of getting no red cards? Tip - google 'playing cards'

Question 3

What is the probability of getting at least one ace when selecting 5 cards from a deck of 52 cards without replacement?

Question 4

There are 3 different magazines A, B and C offered for subscription for a community. 45% of the people in that community subscribe to A, 35% subscribe to B, 30% subscribe to C. 10% subscribe to A & B, 8% subscribe to A & C, 5% subscribe to B & C, 3% subscribe to all the three. Find the probability of: only subscribe to A; only subscribe to one magazine;

Question 5

1% of the population has X disease. A screening test accurately detects the disease for 90% if people with it. The test also indicates the disease for 15% of the people without it (the false positives). Suppose a person screened for the disease tests positive. What is the probability they have it?

Tips:

1. Read the description carefully.

2. Identify the events from question.

Question 6

A jar contains ten marbles (marked from 1 to 10). Four marbles are drawn without replacement, the number noted. Find the probability of:

Smallest number is 5?

Biggest number is 5?

Question 7

A box contains n pairs of shoes (2n shoes in total). If 2r (with the assumption that $2r \leq n$) shoes are selected at random, find the probability for the following scenarios:

A0 = 'No matching pair'

A1 = 'only one matching pair'

A3 = 'exactly two matching pairs'

Question 8

A certain virus infects one in every 400 people. A test used to detect the virus in a person is positive 85% of the time if the person has the virus and 5% of the time if the person does not have the virus. (This 5% result is called a false positive). Let A be the event "the person has the virus" and B be the event "the person tests positive".

a) Find the probability that a person has the virus given that they have tested positive, i.e. find $P(A|B)$. Round your answer to the nearest hundredth of a percent.

b) Find the probability that a person does not have the virus given that they test negative, i.e. find $P(A'|B')$. Round your answer to the nearest hundredth of a percent.

Hints:

Bayes theorem can be written in different ways by applying the different probability rules/laws.

$$P(X|Y) = \frac{P(X,Y)}{P(Y)} \quad [written\ as\ conditional\ probability]$$

$$P(X|Y) = \frac{P(X) \cdot P(Y|X)}{P(Y)} \quad [product\ rule:\ P(X,Y) = P(X) \cdot P(Y|X)]$$

$$P(X|Y) = \frac{P(X) \cdot P(Y|X)}{\sum_{x \in \Omega} P(Y|X=x) \cdot P(X=x)} \quad [sum\ rule:\ P(Y) = \sum_{x \in \Omega} P(Y|X=x) \cdot P(X=x)]$$

R Questions

1. Demonstrate PDF, CDF and Quantile plots for the standard normal distribution

2. Create a function in R to calculate and draw CDF from the following PDF:

$$f(x) = \begin{cases} 0.2, & x \in [0,3) \\ 0.05, & x \in [3,5) \\ 0.15, & x \in [5,6) \\ 0.05, & x \in [7,10) \\ 0, & x \in [10,\infty) \end{cases}$$

Draw the CDF and PDF in the same plot. Label the axes clearly and provide a legend.

3. Create a function to calculate posterior probability using Bayes theorem.

4. Bayes Theorem Question

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b) Find the probability that a person does not have the virus given that they test negative, i.e. find P(A'|B'). Round your answer to the nearest hundredth of a percent.