Assignment-Solutions
Introduction to Probability and Statistics

1. A, marble is drawn at random from a bag containing 3 red and 2 blue marbles. The probability of drawing a black ball is:

    i. 1/5
    ii. 0/5
    iii. 2/5
    iv. 3/5

    Solution - b

2. Consider a scenario where first event has occurred, given the probability of second event coined from the below options

    i. Series probability
    ii. Joint probability
    iii. Dependent probability
    iv. Conditional probability

    Solution - b

3. About 7% of the population are left-handed. Suppose 2 people are selected at random from the U.K population. Because the sample size of 2 is very small relative to the population, it is reasonable to assume these two people are independent.
    i. What is the probability that two people are left-handed?
    ii. Find the probability for right hand too?

    Solution
    i.
    The probability that first person is left – handed =   0.07
    Similarly, for right-handed = 0.07
    Applying multiplication rule for independent processes
        0.07 * 0.07   = 0.0049

    ii.
    Consider ambidextrous (both left and right) = 0
            P (Right-handed) = 1 - 0.07 = 0.93

Using the same reasoning as part a)
The Probability for both being right handed = 0.93 * 0.93 = 0.8649

4. X and Y are two events which are considered as partially overlapping events then rule of addition can be written as
    i.   P(X or Y) = P(X) * P(Y) + P(X - Y)
    ii. P(X or Y) = P(X) + P(Y) - P(X and Y)
    iii. P(X or Y) = P(X) - P(Y) + P(X and Y)
    iv. P(X or Y) = P(X) + P(Y) * P(X - Y)

Solution - c

5. SAM has $1000 and a certain commodity presently sells for $2 per ounce. After 1-week commodity will sell for either $1 or $4 an ounce., with two these possibilities equally likely. If objective is to maximize the expected amount of money that SAM possess at the end of week. What strategy should SAM employ?

Solution

Use SAM money to buy 500 ounces of commodity and then sell after 1 week.
Expected amount of money SAM will get E[money]
               = (1/2) * 500 + (1/2) * 2000 = 1250

6. In the email data set with 3,921 emails, 367 were spam, 2,827 contained some small numbers but no big numbers, and 168 had both characteristics. Create a Venn diagram for this setup.

    i. Use your Venn diagram from Question 5 to determine the probability a randomly drawn email from the email data set is spam and had small numbers (but not big numbers).
    ii. What is the probability that the email had either of these attributes?

Solution
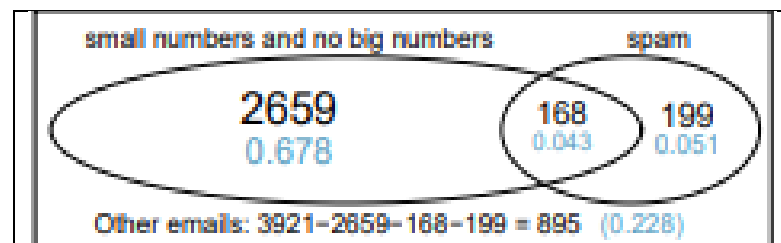
.   The number of emails represented in the left circle = 2659 + 168 = 2827, Number represented in the right circle is = 168 + 199 = 367.

i. The intersection of the two circles: 0.043
ii. The sum of the three disjoint probabilities shown in the circles
$$= 0.678 + 0.043 + 0.051 = 0.772$$

7. Calculate the probability that the total of two dice will be greater than 9, given that the first die is a 5?

   Solution

   Let A = First die A = 5

   Total of two dice B > than 9

   $P(A) = \frac{1}{6}$

   Outcomes which are possible for A and B: (5, 5), (5, 6)

   $P(A$ and $B)$ = Let A = first die is 5

   Let B = total of two dice is greater than 9

   $P(A) = \frac{1}{6}$

   Possible outcomes for A and B: (5, 5), (5, 6)

   $P(A$ and $B) = \frac{2}{36} = 1/18$

   $P(B|A) = P(A$ and $B)/P(A) = 1/18 + 1/6 = 13$

8. In an interview, two reasoning problems, 1 and 2, are asked. 35% job seekers solved problem 1 and 15% job seekers solved both the problems. What is the probability that job seekers who solved the first problem will also solve the second one?

   Solution

   Probability of solving problem 1, P(1)= 0.351
   Probability of solving both problem, P(1 and 2) = 0.15
   Probability of solving 2 if 1 is solved P(2|1) = P(1and2) / P(1) = 0.15/ 35
   = 0.4280