

Probability and Random Processes (15B11MA301)

Tutorial Sheet: 2 [C201.1]

(Total probability, Bayes theorem)

1. The LED bulbs producing factories A, B and C supply LED bulbs to the market in the ratio 2:3:5. It is found that 1% of the items produced in factory A, 2% of the items produced in factory B and 3% of the items produced in factory C are defective. If a bulb is selected at random from the market what is the probability that it is a defective one? Also, if a randomly selected bulb is found to be defective then find the probability that it was produced by factory (i) A, (ii) B, (iii) C?
[Ans (i) 2/23 (ii) 6/23, (iii) 15/23]
2. The frequency of an infected disease in a population is 0.2%. In a routine screening test of it, it is found that the test is highly accurate with a 3% false positive rate (showing positive when it is actually negative) and a 1% false negative (showing negative when it is actually positive) rate. If a person takes the test and it comes out to be positive. What is the probability that the person has the disease?
[Ans: 0.062]
3. Three urns I, II and III contain 8 red, 4 white; 6 red, 6 white; and 5 red, 7 white balls, respectively. If a ball is drawn at random and found to be red, what is the probability that it is a drawn from (i) urn I, (ii) urn III?
[Ans: (i) 8/19, (ii) 5/19]
4. A and B throw alternatively with a pair of balanced dice. A wins if he throws sum of six points before B throws a sum of seven points, while B wins if he throws a sum of seven points before A throws a sum of six points. If A begins the game, show that his probability of winning is 30/61.
5. There are 4 true coins and 1 false coin with head on both sides. A coin is chosen at random and tossed 5 times. If head occurs all the 5 times, what is the probability that the false coin has chosen and used?
[Ans: 8/9]
6. A letter is known to have come either from TATANAGAR or from CALCUTTA. On the envelope just two consecutive letters TA are visible. What is the probability that the letter came from CALCUTTA?
[Ans: 4/11]
7. Three switches connected in parallel operate independently. Each switch remains closed with probability p . Find the probability (a) of receiving an input signal at the output. (b) that switch S_1 is open given that an input signal is received at the output.
[Ans: (i) $p^3 - 3p^2 + 3p$, (ii) $\{(1-p)(2p-p^2)\} / \{p^3 - 3p^2 + 3p\}$]
8. Companies A, B and C produces cars. The production capacity of company A is twice that of B while company B and C produces same number of cars in a given period. It is known that 2% of A, 3% of B and 4% of C are defective. All the cars produced are put into one showroom and then one car is chosen at random. (a) Find the probability that the car is defective. (b) Suppose a car chosen is defective, what is the probability that this is produced by company A?
[Ans: (i) 11/400, (ii) 4/11]