

Assignment 4

Course Code (Name) : BM206(Quantitative Techniques)

Section 1: Problems

Course Covered : Probability & Probability Distributions; Sampling

Instructions : Attempt all questions on your own at the first instance. If you cannot do them on your own, you are free to take help of your batch mates or your course instructor. The assignments need not be submitted but the course instructor reserves the right to ask for the solutions any time.

1. Let $S = \{a_1, a_2, a_3, a_4\}$ and let P is the probability function on S . If $P(a_2) = 1/3$, $P(a_3) = 1/6$, $P(a_4) = 1/9$, what is $P(a_1)$?
2. Six married couples are standing in a room. If 2 – people are chosen at random, find the probability that they are married?
3. An analysis of sales at a departmental store show that 20 percent of the purchases were made by women and that 40 percent of the purchases were over Rs. 50 in value. The records also show that 40 percent of the purchases of over Rs. 50 were made by women. Based on these facts, answer the following:
 - (a) What is the probability of a purchase of over Rs. 50, given that the customer is a woman?
 - (b) What is the probability of a purchase of less than Rs. 50, given that the customer is a man?
 - (c) Are the events 'woman' and 'over Rs. 50' dependent?
4. There are three dispatch assistants A, B and C in an office. Assistant A processes 45% of the letters, B processes 30% of the letters and C processes the remaining. The error rate of A is 6%, that of B is 9% and C is 4%. The manager picked up one letter at random on a particular day and found it to be defective. Calculate the probabilities of the letter being processed by assistant A, assistant B and assistant C respectively.
5. A company estimates the net profit on a new product it is launching to be Rs. 3000000 during the first year, if it is successful, Rs. 1000000 if it is moderately successful and a loss of Rs. 1000000 if it is unsuccessful. The firm assigns the following probabilities to first year's prospects for the product if it is successful and for being moderately successful, the probability is pegged at 0.25. What are the expected values and standard deviation of the first year net profit for this product?
6. A cigarette company wants to promote the sale of XYZ cigarettes with a special advertising campaign. Fifty out of every thousand cigarettes are rolled up in gold foil and randomly mixed with the regular cigarettes. The company offers to trade a new package of cigarettes for each gold cigarette a smoker finds in a package of brand XYZ. What is the probability that buyers of brand XYZ will not find any gold cigarette in a single package of 10?
7. A company manufactures automobile components of various kinds. The quality control policy for a particular type of component stipulates taking random samples of six components at regular intervals. The number of defective components is kept separately in counting process of every sample. Out of 200 such samples, in 108 cases no defectives, in 64 cases one defective, in twenty cases two defectives and in the remaining cases three defectives were recorded. What distribution would you consider to decide whether the manufacturing process is operating with an average of 11% defectives?

8. A multinational bank issuing Master Card is monitoring the use of credit card account holders in the context of their spending habits. A market survey shows that the average monthly spending of its regular card users is normally distributed with mean Rs. 2800 and standard deviation Rs. 900. The customers are classified into four categories according to the pattern of spending:

- (a) Category 1 spends less than Rs. 2000
- (b) Category 2 spends between Rs. 2000 and Rs. 3000
- (c) Category 3 spends between Rs. 3000 and Rs. 4000
- (d) Category 4 spends Rs. 4000 or more

What proportion of customers would you expect to fall in each category?

9. An airlines in a large city, gets on an average 5 claims per day for missing baggage. Using an appropriate probability distribution function, calculate the following probabilities:

- (a) The probability that there are at least 7 claims for missing baggage
- (b) The probability of no claims for missing baggage
- (c) The probability that there are exactly 4 claims for missing baggage

10. Suppose that you want to know the opinions of Assam's Secondary School teachers about establishing a *Provincial Test* for High School Graduation. You obtain a list of the members of the Assam High School Teacher's Association (the largest teacher's union) and mail a questionnaire to 3000 teachers chosen at random from this list. In all, 1529 teachers return the questionnaire. Identify the relevant *population* and *frame* in this case.

11. A sports correspondent wants to know how strongly the residents of Dibrugarh Town support the local Twenty20 Cricket League. She stands outside the stadium before a game and interviews the first 30 people who enter the stadium. Suppose that the newspaper asks you to comment on the approach taken by the correspondent in performing the survey of the local opinion. How do you respond?

12. SystemX has 4250 male and 1167 female employees. The organization's Equal Employment Opportunity (EEO) officer wants to poll the opinions of a random sample of employees. To give adequate attention to the opinions of female employees, exactly how should the EEO officer sample from the given population? Give reasons.

13. Suppose that you want to estimate the mean monthly gross income of all households in your local community. You decide to estimate this population parameter by calling 150 randomly selected residents and asking each individual to report the household's monthly income. Assume that you use the local phone directory as the frame in selecting the households to be included in your sample. What are some possible sources of error that might arise in your effort to estimate this population mean?

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- ✓ Take a bag with you whenever you go shopping to the market. That way, you avoid bringing polybags which ultimately finds its way to the waste basket. These are not bio-degradable and harm the environment.
 - ✓ Take the print out of this assignment in a paper which is already used on one side. This can help save paper and associated costs. In fact, make it a habit to always use papers to the optimum. Even envelopes just thrown away can be used to do rough work.
 - ✓ Check to see that all electrical appliances are switched off when they are not being used. Switch to CFLs. You can do a lot to save power.
 - ✓ Make it fashionable to be environmentally conscious and aware. You can make a real difference to the only place we have to live called EARTH.
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