# AX-101

**May-2016**

**B.Sc., Sem.-II**

**CC-103 – Statistics**

**(Basic Probability Theory-1)**

**Time : 3 Hours]**          **[Max. Marks : 70**

**Instructions :**    (1)    **All** questions **(Q-1 to Q-4)** carry equal marks.

               (2)    **Question-5 : 2** marks for each part.

               (3)    Scientific calculator can be used.

1.    (a)    What do you understand by 'Dispersion' ? Distinguish between relative and absolute measures of dispersion and describe the merits and demerits of standard deviation.

**OR**

The following are some of the particulars of the distribution of weight of boys and girls in a class :

|  | **Boys** | **Girls** |
|---|---|---|
| Number | 100 | 50 |
| Mean weight | 60 kg | 45 kg |
| Variance | 9 | 4 |

(i)    Find standard deviation of the combined data.

(ii)    Which of the two distributions is more varying, the boys or girls ?

   (b)    Define the row and central moments of a frequency distribution. Obtain the relation between the central moments of order r in terms of the row moments.

**OR**

Distinguish between skewness and kurtosis. Explain the methods of measuring skewness and kurtosis of a frequency distribution.

2. (a) Define the following terms with appropriate example :

   (i) Independence of events

   (ii) Pair wise and mutual independence of events

   **OR**

   A bag contains 30 balls numbered from 1 to 30. One ball is drawn at random. Find the probability that the number of the ball drawn will be a multiple of (i) 5 or 7, (ii) 3 or 7.

   (b) In usual notations state and prove Bayes Theorem of probability.

   **OR**

   In a bolt factory machines A, B and C manufacture respectively 25%, 35% and 40% of the total. Of their outputs 5%, 4%, 2% are defective bolts respectively. A bolt is drawn at random from the product and is found to be defective. What are the probabilities that it was manufactured by machines A, B and C ?

3. (a) What is meant by a time series ? Describe its important components with illustrations.

   **OR**

   Explain briefly the method of moving average of determining trend in a time series.

   (b) What is meant by trend of a time series ? How would you fit a second degree trend by the principle of least squares ?

   **OR**

   Distinguish between ratio to trend and ratio to moving average methods of measuring seasonal variations in time series. Which is better and why ?

4. (a) Explain briefly the 'Statistical Decision Theory'.

   **OR**

   A businessman wants to construct a hotel. He usually builds 25, 50 or 100 beds hotel, depending on whether anticipated demand is low, medium or high. The businessman has been able to find out net profits which are expressed in the table below and the prior distribution regarding the states of nature is given in the next table.

**PAYOFF TABLE**

| Action / States of Nature | $a_1$<br>Build 25-beds hotel | $a_2$<br>Build 50-beds hotel | $a_3$<br>Build 100-beds hotel |
|---|---|---|---|
| $\theta_1$ = Low demand | 20,000 | −10,000 | −30,000 |
| $\theta_2$ = Medium demand | 25,000 | 30,000 | −5,000 |
| $\theta_3$ = High demand | 30,000 | 50,000 | 60,000 |

**PRIOR DISTRIBUTION**

| States of nature = Demand | $\theta_1$ | $\theta_2$ | $\theta_3$ | Total |
|---|---|---|---|---|
| Prior probabilities $g\,(\theta_1)$ | 0.2 | 0.3 | 0.5 | 1.0 |

(i) Compute EP, EPPI and EVPI.

(ii) A research firm agrees to conduct a survey for ₹ 8,000 for a businessman and provides him with information regarding the states of nature. Should the survey be conducted ?

(b) Distinguish between 'decision making under risk' and 'decision making under uncertainty'.

**OR**

A food product company is contemplating the introduction of a revolutionary new product with new packaging to replace the existing product at much higher price ($S_1$) or a moderate change in the composition of the existing product with a new packaging at a small increase in a price ($S_2$) or a small change in the composition of the existing product except the word 'New' with a negligible increase in price ($S_3$). The three possible states of nature of events are (i) high increase in sales ($N_1$), (ii) no change in sales ($N_2$) and (iii) decrease in sales ($N_3$). The marketing department of the company worked out the payoffs in terms of yearly net profits for each of the strategies for these events (expected sales). This is represented in the following table :

| State of Nature / Strategies | Profits (in ₹) | | |
|---|---|---|---|
| | $N_1$ | $N_2$ | $N_3$ |
| $S_1$ | 7,00,000 | 3,00,000 | 1,50,000 |
| $S_2$ | 5,00,000 | 4,50,000 | 0 |
| $S_3$ | 3,00,000 | 3,00,000 | 3,00,000 |

Which strategy should the executive concerned choose on the basis of

(i)   Maxi-min principle,

(ii)  Maxi-max principle,

(iii) Laplace principle,

(iv)  Hurwitz principle ($\alpha = 0.7$).

5.   Answer the following questions :

(i)   Distinguish between mean deviation and standard deviation. Which is considered better and why ?

(ii)  Write the properties of a good measure of variation.

(iii) The odds against Manager X settling the wage dispute with the workers are 8:6 and odds in favour of Manager Y settling the same dispute are 14 : 16. What is the probability that the dispute will be settled ?

(iv)  Which component of time series is mainly applicable in the following cases ?

(a)  Fire in Factory

(b)  Fall in death rate due to advances in science.

(v)   Explain the terms : EOL, EVIP.

(vi)  Give the classical and statistical definitions of probability.

(vii) What is optimal decision ?

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