2015

STATISTICS

[General]

PAPER – I

Full Marks : 90

Time : 3 hours

The figures in the right hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

Illustrate the answers wherever necessary

[NEW SYLLABUS]

GROUP – A

(*Probability*)

[*Marks* : 25]

1. Answer any *one* questions : 10×1

(*a*) State Bayes' theorem. If A and B are two events such that $P(B) > 0$, prove that

(*i*) $P(A \mid B) \geq 1 - \dfrac{P(A^C)}{P(B)}$

(*ii*) $P(A \mid B) = 1 - P(A^C \mid B)$ $2 + 4 + 4$

(*b*) Write down the pdf of Normal distribution. Obtain median of normal distribution. Show that

$E(X^{2r}) = (2r - 1)(2r - 3) \ldots 3.1$ if $X \sim N(0, 1)$

where r is a positive interger. $2 + 3 + 5$

2. Answer any *three* questions : 5×3

(*a*) For any two events A and B prove that

$$P(A \cup B) = P(A) + P(B) - P(AB)$$

(*b*) Define cumulative distribution function of a random variable and state its properties.

(*Continued*)

(*c*) Suppose an urn contains 4 balls numbered 1, 2, 3, 4 respectively. Let X be the number that occurs if one ball is drawn at random from the urn. Obtain the probability mass function of the random variable X.

(*d*) Obtain c for which the following function is a density function of random variable X:

$$f(x) = c.e^{-\frac{x}{\theta}}, 0 < x < \infty, \theta > 0$$

(*e*) When are two events said to be independent ? Distinguish between pair wise independence and mutual independence for a set of events.

(*f*) Check whether the following function can be accepted as a probability density function :

$$f(x) = \frac{3}{\sqrt{\pi}} e^{-9x^2}, \quad -\infty < x < \infty$$

GROUP – B

(*Descriptive Statistics*)

[*Marks* : 45]

3. Answer any *two* questions : 10×2

(*a*) What is scatter diagram ? Define Pearson's product-moment correlation Coefficient. Show that the correlation coefficient lies between -1 and $+1$. $2 + 3 + 5$

(*b*) Define multiple correlation and partial correlation. Show that for three variables x_1, x_2 and x_3

$$\left(1 - r_{1.23}^2\right) = \left(1 - r_{12}^2\right)\left(1 - r_{13.2}^2\right),$$

where $r_{13.2}$ is the partial correlation coefficient between x_1 and x_3 given x_2, r_{12} is the correlation coefficient between x_1 and x_2 and $r_{1.23}$ is the multiple correlation coefficient. $3 + 7$

(*c*) What do you mean by skewness and kurtosis of a frequency distribution ? Show that, $b_2 \geq b_1 + 1$ (Symbols have their usual meanings) $4 + 6$

(*d*) Explain the following terms with appropriate examples : Relative dispersion, Ogive. $5 + 5$

(*Continued*)

4. Answer any *five* questions : 5×5

(*a*) Describe the different parts of a statistical table ?

(*b*) Distinguish between a bar diagram and a histogram.

(*c*) What do you mean by central tendency of a frequency distribution ? Give two measures of central tendency and point out situations, where you prefer one measure to the other.

(*d*) Show that standard deviation is zero if and only if all the observations are equal.

(*e*) Prove that,

$$|\text{Mean} - \text{Median}| \leq \text{Standard deviation}.$$

(*f*) Show that the range is dependent on the change of scale but is independent of any change of origin of the variable.

(*g*) What is standard deviation ? Show that, the standard deviation of first n odd numbers and that of the first n even numbers are equal.

(*h*) For two regression lines : $3x + 2y = 25$ and $6x + y = 30$ of the variables x and y identify the regression lines.

(*i*) Draw the scatter diagram for the following cases :

(*I*) $r = 1$

(*II*) $r = -1$

where r is the correlation coefficient.

(*j*) Mentioning the meanings of all the notations, state the formula of Spearman's rank correlation coefficient in the case of no ties and hence study the cases of its values -1 and $+1$.

GROUP – C

(*Economic Statistics, Official Statistics*)

[*Marks* : 20]

5. Answer any *one* question : 10×1

(*a*) What is a consumer price index number ?

(*Continued*)

Describe the different steps in the construction of a consumer price index number. Also mention the different problems in construction of a consumer price index number. 2 + 5 + 3

(*b*) What are the different methods for determining trend in time series ? Describe the method of fitting exponential trend equation to time series data. 3 + 7

Answer any *two* questions : 5 × 2

(*a*) Show that the factor reversal test and time reversal test are not statisfied by Laspeyres' index number.

(*b*) Mention the role of CSO in Indian official statistics.

(*c*) Discuss the different uses of index numbers.

(*d*) What is seasonal variation in time series ? What are the different methods for obtaining seasonal component ?
