## 2015

## ECONOMICS

( Major )

Paper : 5.2

*Full Marks* : 60

*Time* : 3 hours

*The figures in the margin indicate full marks for the questions*

## ( For Arts Stream )

## ( Basic Statistics for Economics )

1. *(a)* Answer the following questions :  1×4=4

   *(i)* Find the median of the natural numbers 1 to 11.

   *(ii)* If $\bar{x} = 40$ and $\sigma_x = 10$, find the coefficient of variation.

   *(iii)* Give an example of discrete random variable.

   *(iv)* A bag contains 3 white and 4 red balls. Find the probability of drawing a red ball.

( *Turn Over* )

(b) Indicate whether the following statements are *True* or *False* :    1×3=3

    (i) Correlation always signifies a cause and effect relationship between the variables.

    (ii) Both the regression coefficients cannot exceed 1.

    (iii) A normal curve is completely defined by the mean and the standard deviation.

**2.** Answer the following questions :    2×4=8

(a) Define mathematical expectation of a random variable. Give one example.

(b) Prove that the arithmetic mean of two regression coefficients is greater than the correlation coefficient.

(c) If $Q_1 = 142$ and $Q_3 - Q_1 = 18$, find the median (it is assumed that the distribution is symmetrical about median).

(d) Given $b_{yx} = -1·4$ and $b_{xy} = -0·5$, calculate $r_{xy}$.

*( Continued )*

**3.** Answer the following questions (any *three*) :

$5×3=15$

*(a)* A random variable $X$ has the following probability distribution :

| $X$ | : | $-2$ | $-1$ | $0$ | $1$ | $2$ |
|---|---|---|---|---|---|---|
| $P(X = x)$ | : | $\frac{1}{12}$ | $\frac{1}{6}$ | $\frac{1}{4}$ | $\frac{1}{6}$ | $\frac{1}{12}$ |

Compute $E(X)$ and $V(X)$.

*(b)* The arithmetic mean and standard deviation of a series of 20 items were calculated by a student as 20 cm and 5 cm respectively. But while calculating them, an item 13 was misread as 30. Find the correct AM and SD.

*(c)* Prove the Karl Pearson's correlation coefficient $r$ lies between $-1$ and $+1$, i.e. $-1 \leq r \leq 1$.

*(d)* State the properties of Poisson distribution. Mention one practical situation where such distributions can be used.

*(e)* Explain the difference between correlation and regression analysis.

**4.** Answer the following questions (any *three*) :

$10 \times 3 = 30$

(a) Which measure of central tendency is the best and why? Compute the arithmetic mean from the following data by step deviation method :

| Marks | : | 0–10 | 10–20 | 20–30 | 30–40 |
|---|---|---|---|---|---|
| No. of Students | : | 5 | 10 | 25 | 30 |
| Marks | : | 40–50 | 50–60 | | |
| No. of Students | : | 20 | 10 | | |

Also locate approximate value of the mode graphically. 3+4+3

(b) Explain the term 'regression'. Briefly explain the principle of least squares used for the estimation of linear regression.

The correlation coefficient between two variables $X$ and $Y$ is $r = 0 \cdot 6$. If $\sigma_x = 1 \cdot 50$, $\sigma_y = 2 \cdot 00$, $\bar{x} = 10$ and $\bar{y} = 20$, find the regression line of $Y$ on $X$. 2+5+3

(c) Explain the distinctive features of binomial and normal distribution. If the probability of a defective bolt is 0·2, find (i) the mean and (ii) the standard deviation of defective bolts in a total of 900 bolts. 8+2

(d) (i) Define classical or a priori probability.

(ii) Let $A$ and $B$ be two possible outcomes of an experiment and suppose

$P(A) = 0 \cdot 4, \quad P(A \cup B) = 0 \cdot 7,$
$P(B) = p$ and $P(A \cap B) = 0 \cdot 2.$

Find the value of $p$ if

(1) $A$ and $B$ are mutually exclusive

(2) $A$ and $B$ are independent.

(iii) An urn contains 6 white and 8 red balls. A second urn contains 8 white and 12 red balls. One ball is drawn at random and put into the second urn without noticing its colour. A ball is then drawn at random from the second urn. What is the probability that it is white?

$$1+(2+2)+5$$

(e) Define Spearman's rank correlation coefficient. Calculate Spearman's rank correlation coefficient between advertisement cost and sales from the following data :

| Advertisement Cost ('000 ₹) | : | 39 | 65 | 62 | 90 | 82 |
|---|---|---|---|---|---|---|
| Sales (₹ in Lakh) | : | 47 | 53 | 58 | 86 | 62 |
| Advertisement Cost ('000 ₹) | : | 75 | 25 | 98 | 36 | 78 |
| Sales (₹ in Lakh) | : | 68 | 60 | 91 | 51 | 84 |

Comment on the following :

"The coefficient of correlation $r = 0 \cdot 8$ implies that 80% of the variation is explained."

$$2+6+2$$

(f)   (i)   If the two lines of regression are

$$4x - 5y + 30 = 0$$
$$20x - 9y - 107 = 0$$

then which of these is the line of regression of $x$ on $y$?   6

(ii)   Distinguish between absolute dispersion and relative dispersion.   4

( Continued )

( For Science Stream )

**( Elementary Econometrics )**

5. Answer the following as directed :      1×7=7

   (a)   Define standard error.

   (b)   What is a null hypothesis?

   (c)   Name the type of error rejecting a true hypothesis.

   (d)   Mention one test that is used for testing large sample.

   (e)   The overall goodness of fit of a linear regression model is measured by _____.

                             (Fill in the blank)

   (f)   Name the problem that arises in the estimation of a linear regression model when the assumption of $E(u_i, u_j) = 0;\ i \neq j$ is violated.

   (g)   What do you mean by level of significance?

                                      

6. Answer any *four* of the following :  2×4=8

(a) Comment on the following :

The mean of a binomial distribution is 15 and its standard deviation is 5.

(b) State the conditions under which a binomial distribution tends to Poisson distribution.

(c) Mention the properties of a good point estimator.

(d) What is the critical value of $z$ at 1 percent and 5 percent level of significance for a right-tailed normal test?

(e) Mention two properties of normal distribution.

(f) Find the binomial distribution whose mean is 6 and variance is 4.

7. Answer any *three* of the following :  5×3=15

(a) What is an estimator? Explain with illustration, the concept of (i) point estimator and (ii) interval estimator.

1+2+2

*( Continued )*

*(b)* Distinguish between one-tailed test and two-tailed test. 5

*(c)* Prove that for a Poisson distribution mean and variance are same and is equal to its parameter. 5

*(d)* Explain the conditions that should be satisfied for applying 'chi-square test'. 5

*(e)* The incidence of occupational diseases in an industry is such that the workers have a 25% chance of suffering from it. What is the probability that out of 6 workers 4 or more will contact diseases? 5

**8.** Answer any *three* of the following : 10×3=30

*(a)* In an industry, 200 workers, employed for a specific job, were classified according to their performance and training received. The data is summarized in the following table. Is there any association between the performance and training received by the workers? [Given that chi-square

value at 1% and 5% level of significance
with 1 degree of freedom is 6·64 and
3·84 respectively]                                    10

|           | Performance |          | Total |
|-----------|-------------|----------|-------|
|           | Good        | Not Good |       |
| Trained   | 100         | 50       | 150   |
| Untrained | 20          | 30       | 50    |
| Total     | 120         | 80       | 200   |

*(b)* Prove that ordinary least squares
estimators are Best Linear Unbiased
Estimators (BLUE).                                 10

*(c)* What is the justification for introducing
the random disturbance term in a linear
regression model? What are the various
assumptions made for disturbance term
in the model?                                         5+5

*(d)* A random sample of 20 daily workers
of state *A* was found to have average
daily earning of ₹ 44 with standard
deviation 30. Another sample of 20 daily
workers from state *B* was found to earn
an average of ₹ 30 per day with standard
deviation 20. Test whether the workers
in state *A* are earning more than those
in state *B*. [ $t_{0.05} = 1·645$ for 38 d.f. ].      10

(e) The income distribution of officers of a certain company was found to follow normal distribution. The average income of the officers was ₹ 15,000. The standard deviation of the income of the officers was ₹ 5,000. If there were 242 officers drawing salary above ₹ 18,500, how many officers were there in the company? [ The area under standard normal curve between 0 and 0·7 is 0·2580 ]                 10

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