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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)

1. *(a)* Choose the correct answer from each of the following : 1×3=3

   (i) The GM of two numbers 8 and 18 shall be

   (1) 12

   (2) 13

   (3) 15

   (4) 11·08

(*Turn Over*)

    (ii) Coefficient of determination is defined as

        (1) r^3

        (2) $1 + r^2$

        (3) r^2

        (4) None of the above

    (iii) If coefficient of variation of distribution is 50, standard deviation $= 20$, the value of $\bar{x}$ is

        (1) 10

        (2) 30

        (3) 40

        (4) 45

(b) Answer the following questions : $1 \times 2 = 2$

    (i) What are quartiles?

    (ii) Define partial correlation.

(c) State whether the following statements are *True* or *False* : $1 \times 2 = 2$

    (i) The regression lines cut each other at the point of average of X and Y.

    (ii) Dependent events are those in which the outcome of one does not affect and is not affected by the other.

        (*Continued*

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

   (a) State the relationship between AM, GM and HM. What is the problem of using AM when there are open-ended class intervals?   1+1

   (b) If the linear regression coefficient $b_{yx} = 0 \cdot 6$ and the variances σ_x^2 and σ_y^2 are 600 and 300 respectively, calculate Karl Pearson's correlation coefficient and the linear regression coefficient b_{xy}.

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

   (d) If a random variable X follows the Poisson pattern such that $P(X = 1) = P(X = 2)$, find the mean of the distribution.

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

                                          5×3=15

   (a) Assume that in a particular case, the sample mean is 27·5. What would be the sample mean if the frequencies are doubled?

        State the relationship between mean, median and mode. What happens to the relationship in case of a symmetrical distribution?   2+2+1

(b) Prove that if E and F are independent events, then so are the events E' and F'. 5

(c) Briefly explain the method of least squares used in curve fitting. 5

(d) The mean deviation about mean is given by $D = \dfrac{1}{\Sigma f} \Sigma f |x - \bar{x}|$, the symbols being with their usual meanings.

If you use $(x - \bar{x})$ instead of $|x - \bar{x}|$ in the above expression, what would be the numerical value of the new expression?

In two factories, A and B, engaged in the same industry in the area, the average weekly wages and the standard deviations are as follows :

Factory	Average (₹)	SD	No. of employees
A	34·5	5·0	476
B	28·5	4·5	524

(i) Which factory, A or B, pays out a larger amount on weekly wages?

(ii) Which factory, A or B, has greater variability in individual wages? 2+3

(e) A normal curve has $\bar{X} = 20$ and $\sigma = 10$. Find the area between $X_1 = 15$ and $X_2 = 40$. Given $P(0 \le Z \le 0·5) = 0·1915$ and $P(0 \le Z \le 2) = 0·4772$.

State the conditions required to apply binomial distribution. 3+2

　　　　　　(Continued

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

$$10 \times 3 = 30$$

(a) What are the requisites for an ideal measure of central tendency? What is quartile deviation? Compute quartile deviation from the following data :   4+1+5

Marks	Frequencies
10	4
20	7
30	15
40	8
50	7
60	2

(b) State the addition and multiplication theorems of probability.

If $A \subseteq B$, prove that $P(A) \leq P(B)$.

The probability that a boy will get a scholarship is 0·9 and that a girl will get is 0·8. What is the probability that at least one of them will get the scholarship?   3+4+3

(c) Explain the concept of various probability distributions. State the conditions under which Poisson distribution can be a reasonable approximation of the binomial.   7+3

(d) The following set of (X, Y) are given :

$(X, Y) : (2, 5), (3, 8), (4, 9), (5, 12), (6, 13)$

Assuming that regression analysis is valid in this case, fit the regression

equation of X on Y and compute the expected value of X given that $Y = 14$.

Given that the regression equations of Y on X and of X on Y are respectively $Y = X$ and $4X - Y = 3$. Find the correlation coefficient between X and Y. 7+3

(e) State the addition and multiplication theorems of mathematical expectation.

A random variable assumes the value 1 with probability p, and 0 with probability $q = 1 - p$. Prove that (i) $E(X) = P$, (ii) $E(X - \overline{X})^2 = pq$. Distinguish between discrete and continuous random variables. Prove that var $(c) = 0$ where c is constant. 3+4+2+1

(f) Consider the table given below :

No. of Accidents	Frequency (Number of Days)
0	46
1	?
2	?
3	25
4	10
5	5
Total	= 200

If the mean is found to be 1·46, calculate the missing frequencies.

Mention the merits and demerits of mean, median and mode as measures of central tendency. 5+5

(For Science Stream)

(**Elementary Econometrics**)

5. Answer the following questions : 1×7=7

(a) What is a Bernoulli trial?

(b) What is the total area under the normal probability distribution curve equal to?

(c) What probability model is appropriate to describe a situation where 100 misprints are distributed randomly throughout the 100 pages of a book?

(d) What is a null hypothesis?

(e) Name one test that is used for testing large samples.

(f) Mention any two uses of the t-test statistic.

(g) What is partial correlation?

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

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

(b) In a normal distribution, what percentage of observations lies within the range $x \pm \sigma$ and $x \pm 2\sigma$ respectively?

(c) Distinguish between a discrete random variable and a continuous random variable.

(d) Consider the following null and alternative hypothesis :

$$H_0 : \mu \leq \mu_0 \text{ and } H_1 : \mu > \mu_0$$

State whether a single- or two-tailed test is suitable to test the above hypothesis. Give reasons for your answer.

7. Answer any *three* of the following questions :

(a) If X has a Poisson distribution with parameter λ, then show that $E(X) = V(X) = \lambda$. 5

(b) Write a short note on the standard normal variate. 5

(c) Distinguish between point estimation and interval estimation. Mention the properties of a good point estimator. 3+2

(d) Discuss the various errors that arise in the testing of hypothesis. 5

(e) Distinguish between deterministic and stochastic relation with suitable examples. 5

8. Answer any *three* of the following :

(a) Give the p.m.f. of a binomial distribution. Mention the properties of this distribution.

The probability that an evening college student will graduate is 0·4. Determine the probability that out of 5 students, (i) none, (ii) one and (iii) at least one will graduate. 1+3+6

(b) State any four properties of the normal distribution.

Assume that the test scores from a college admission test are normally distributed with a mean of 450 and a standard deviation of 100.

(i) What percentage of student taking the test score between 350 and 650?

(ii) What is the percentage of student scoring less than 550? 4+6

(c) Discuss the various steps involved in testing of hypothesis. Explain the significance of the critical region in hypothesis testing. 5+5

(d) In the context of hypothesis testing, explain the z-test along with its applications.

A sample of 100 tyres is taken from a lot. The mean life of the tyres is found to be 39350 km with a standard deviation of 3260 km. Could the sample come from a population with a mean life of 40000 km?   5+5

(e) Two hundred adults were asked whether TV shows as a whole were primarily entertaining, educational or a waste of time (only one answer could be chosen). The respondents were categorised by gender. Their responses are given in the following table. Is this evidence convincing that there is a relation between gender and opinion in the population interest?   10

(Given that critical value of χ^2 at 5% level of significance and 2 degrees of freedom is 5·99.)

Gender	Opinion			Total
	Entertaining	Educational	Waste of time	
Female	52	28	30	110
Male	28	12	50	90
Total	80	40	80	200

(*Continued*)

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

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