Total No. of Printed Pages—6

ECO : SE H-507

2017

(November)

ECONOMICS

(Honours)

SEVENTH PAPER

(Quantitative Methods for Economic Analysis)

Full Marks : 100

Pass Marks : 35

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer **all** questions

1. Give very short answers of the following : 3×5=15

(a) State three advantages of mathematical approach to economic analysis.

(b) The Cobb-Douglas production function for an economy is given by

$$Q = AL^{\alpha}K^{\beta}$$

where A, α and β are constants such that $\alpha + \beta = 1$. Show that Q is a linear homogeneous function of L and K.

(Turn Over)

(c) Find the probability that at least one head appears in three tosses of a fair coin.

(d) Show that r_{xy} is the geometric mean of b_{xy} and b_{yx}.

(e) What does a wholesale price index measure?

2. Give short answers of the following questions : 5×5=25

(a) Given the following national income model :

$$C = a + bY$$
$$I = d + eY$$
$$Y = I + C$$

Solve for the endogenous variables using Cramer's rule.

(b) Find the elasticity of substitution for the following production function :

$$Q = \sqrt{LK}$$

where Q represents quantity of output produced, L and K represent labour and capital used.

(c) A purse contains 2 silver coins and 4 copper coins and a second purse contains 4 silver coins and 3 copper coins. If a coin is selected at random from one of the two purses, what is the probability that it is a silver coin?

(d) Analyse briefly the components of a time series.

(e) Splice the following two series of index numbers together so as to give a continuous series with base 2013 = 100 :

Year	:	2010	2011	2012	2013	2014	2015	2016
Old series	:	100	130	150	160			
New series					100	150	140	160

3. An employer decides to offer a cash gift of 5% of the average monthly salary of his factory to every employee. Calculate it, taking the average to be (i) the mode and (ii) the median : 6+6=12

Monthly Salary (in '000 ₹)	*Number of employees*
20–30	28
30–40	32
40–50	45
50–60	60
60–70	55
70–80	40
80–90	20
	$N = 280$

Or

If $A = \begin{bmatrix} 2 & 0 \\ 3 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 0 & 1 \\ 2 & 4 \end{bmatrix}$, verify that $(AB)^{-1} = B^{-1}A^{-1}$. 12

4. Given the following data :

Advertising Expenditures (₹'000)	:	12	15	23	24	38	48
Sales (₹ lakh)	:	5·0	5·6	5·8	7·2	9·2	10

(a) Calculate the regression equation of sales on advertising expenditure.

(b) Estimate the probable sales when advertising expenditure is ₹ 60,000.

(c) Calculate the coefficient of correlation between advertising expenditure and sales. 4+4+4=12

Or

The two regression equations between x and y are

$$10x - 20y - 14 = 0$$

$$5x - 6y - 47 = 0$$

The standard deviation is 9.

Find—

(a) the mean values of x and y;

(b) the variance of y;

(c) the coefficient of correlation between x and y. 4+4+4=12

5. A consumer's utility function for two goods is $u = 3x^2y^3$. Using Lagrange multiplier method, find his demand for the two goods, x and y, if price of x = ₹ 2, price of y = ₹ 3 and his income = ₹ 15. Examine the second-order condition for maxima of utility. 8+4=12

Or

The demand function for a good is given by

$$Q = 5y + 4y^3 - 10p^3 - 80p^{-5},\ y > 0,\ p > 0$$

where Q is quantity demanded, y is income and p is price.

(a) Find the slope of the demand curve.

(b) Is the good a normal good or an inferior good?

(c) Is the reaction of demand to price independent of the level of income?

4+4+4=12

6. A husband and wife appear in an interview for two vacancies in the same post. The probability of the husband's selection is 1/7 and that of the wife's selection is 1/5. Find the probability that *(a)* both of them are selected and *(b)* only one of them is selected.

6+6=12

Or

Find the probability of scoring a total of 7 points *(a)* once, *(b)* at least once and *(c)* twice in two tosses of a pair of fair dice.

4+4+4=12

7. Given the following data :

Items	*Wholesale Prices in Rupees*		
	2010	*2013*	*2016*
Rice	15	25	35
Wheat	9	15	15
Pulses	20	25	30
Fish	100	140	150
Oil	15	16	20

Calculate *(a)* wholesale price indices for the years 2013 and 2016 and *(b)* the rates of inflation.

8+4=12

Or

Calculate quantity index numbers for the years 2015 and 2016 with 2014 = 100 from the following data :

6+6=12

Items	*Prices*	*Production*		
		2014	*2015*	*2016*
A	34	42	53	54
B	12	25	30	40
C	5	12	10	10
D	3	6	5	6
E	6	11	12	15

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Total No. of Printed Pages—7

ECO : SE H–507

2018

(November)

ECONOMICS

(Honours)

SEVENTH PAPER

(Quantitative Methods for Economic Analysis)

Full Marks : 100

Pass Marks : 35

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer **all** questions

1. Write very short answers of the following : 3×5=15

(a) State the difference between mathematical economics and non-mathematical economics.

(b) Show that $Q = \sqrt{L^2 + K^2}$ is a linear homogeneous production function, where L and K are the two inputs, labour and capital required to produce Q.

(c) A pair of dice is thrown. Find the probability that the sum of the numbers on the dice is 8.

(d) Distinguish between seasonal component and cyclical component of a time series.

(e) What is base shifting? Why does it become necessary to shift the base of index numbers?

2. Write short answers of the following : 5×5=25

(a) Solve the following national income model using Cramer's rule :

$$Y = C + I_0 + G_0$$

$$C = a + b(Y - T) \qquad [a > 0,\ 0 < b < 1]$$

$$T = d + tY \qquad [d > 0,\ 0 < t < 1]$$

(b) Find the elasticity of substitution for the production function

$$Q = \sqrt{LK}$$

where Q represents quantity of output produced, L and K labour and capital used.

(c) State and explain the law of large numbers.

(d) Write a critical note on method of moving average as a technique to measure the trend component of a time series.

(e) State the usefulness of the wholesale price index.

3. Given :

$$A = \begin{bmatrix} 6 & 8 \\ 1 & 2 \end{bmatrix}$$

Prove that $(A^{-1})^t = (A^t)^{-1}$. 12

Or

The following table shows the distribution of lifetime of two models of refrigerators :

Lifetime (in years)	*Model A*	*Model B*
0–2	5	2
2–4	16	7
4–6	13	12
6–8	7	19
8–10	5	9
10–12	6	1

(a) Which model has a longer average life?

(b) Which model has greater uniform durability? 6+6=12

4. State the essence of Lagrange multiplier method in constrained optimization.

Given the utility function : $U = 4q_1^{3/4} q_2^{1/4}$ and the budget constraint : $3q_1 + \frac{1}{2} q_2 = 120$.

Find the values of q_1 and q_2 at which utility is maximum. 4+8=12

Or

A consumer has a utility function

$$U = x^{1/2} y^{1/3}$$

where x and y are two commodities and U is the utility.

(a) Show that there is diminishing marginal utility to increase consumption of either commodity when the consumption of the other is held constant.

(b) What happens to the marginal utility of x as y is increased and vice versa? 6+6=12

5. The probability that a man will be alive in 25 years is $\frac{3}{5}$ and the probability that his wife will be alive in 25 years is $\frac{2}{3}$.

Find the probability that—

(a) both will be alive;

(b) only the wife will be alive;

(c) at least one will be alive. 4×3=12

Or

Two marbles are drawn in succession from a box containing 10 red, 30 white, 20 blue and 15 orange marbles, replacement being made after each drawing.

Find the probability that—

(a) the first is red and the second is white;

(b) at most one is red;

(c) at least one is blue. 4×3=12

6. The following data relate to advertising expenditure and sales (in lakhs of ₹) :

Advertising expenditure	:	12	15	18	20	25
Sales	:	15	25	30	50	60

Estimate *(a)* the sales corresponding the advertising expenditure of ₹ 30 lakhs, *(b)* the advertising expenditure for a sale of ₹ 35 crores and *(c)* the coefficient of correlation between advertising expenditure and sales. 4+4+4=12

Or

Given two regression lines

$$9x + 3y = 46$$

$$3x + 12y = 19$$

(a) Determine which one is the regression of Y on X and which one is that of X on Y.

(b) Calculate $\bar{X}$ and $\bar{Y}$.

(c) Calculate the coefficient of correlation between X and Y. 4+4+4=12

7. Distinguish between the consumer price index and the wholesale price index. An enquiry into the budgets of middle-class families in a city gave the following information :

Items	*Food*	*Clothing*	*Fuel*	*Rent*	*Others*
Expenses (in %)	35	15	20	10	20
Prices (in 2015)	150	50	45	300	40
Prices (in 2018)	200	75	90	400	60

Find the change in the consumer price index in 2018 on the basis of 2015. 6+6=12

(Continued)

Or

Calculate Fisher's price index number from the following data and show that it satisfies both the time-reversal tests as well as factor-reversal test : 4+8=12

Commodity	*Base Year*		*Current Year*	
	Price (₹)	*Quantity*	*Price* (₹)	*Quantity*
A	6	40	10	50
B	3	100	5	60
C	5	30	10	30
D	8	50	12	40

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ECO : SE H-507

5th Semester Exam., 2020
(Held in 2021)

ECONOMICS

(Honours)

SEVENTH PAPER

(Quantitative Methods for Economic Analysis)

Section–A for Regular Candidates

Full Marks : 70
Pass Marks : 25

Section–A and Section–B for Back/Casual Candidates

Full Marks : 100
Pass Marks : 35

Time : 3 hours

The figures in the margin indicate full marks for the questions

(Turn Over)

SECTION—A

1. Write very short answer of the following : 3×3=9

(a) State three advantages of mathematical approach to economic analysis.

(b) Show that $Q = \sqrt[3]{L^2K}$ is a linear homogeneous production function.

(c) Distinguish between seasonal component and cyclical component of time series.

2. Give short answer of the following : 5×5=25

(a) Given the following national income model :

$$C = a + bY$$

$$I = d + eY$$

$$Y = I + C$$

Solve for the endogenous variable using Cramer's rule.

(Continued)

(b) Find the elasticity substitution for the Cobb-Douglas production function

$$Q = AK^{\alpha}L^{1-\alpha}$$

(c) Point out the distinctive features of binomial probability distribution.

(d) Distinguish between correlation and regression.

(e) State the uses of index numbers.

3. Calculate the mean and median of the frequency distribution given below :

Class Limit	*Frequency*
0–10	10
10–20	20
20–30	35
30–40	40
40–50	25
50–60	25
60–70	15

Hence calculate the mode using the empirical relation between mean, median and mode. 4+4+4=12

Or

If $A = \begin{bmatrix} 2 & 0 \\ 3 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 0 & 1 \\ 2 & 4 \end{bmatrix}$, verify that

$$(AB)^{-1} = B^{-1}A^{-1}$$ 12

4. State the essence of the Lagrange multiplier method in constrained optimization. Given the utility function $U = 4q_1^{3/4}q_2^{1/4}$

and the budget constraint $3q_1 + \frac{1}{2}q_2$.

Find the values of q_1 and q_2 at which utility is maximum. 4+8=12

Or

Calculate price index number from the following data using Fisher's method and show that it satisfies time-reversal and factor-reversal tests : 4+4+4=12

Commodity	*Base Year*		*Current Year*	
	Price	*Quantity*	*Price*	*Quantity*
A	10	40	12	45
B	11	50	11	52
C	14	30	17	30
D	8	28	10	29
E	12	15	13	20

(Continued)

5. State and prove multiplication theorem of probability. 5 men in a group of 20 are graduates. If 3 men are picked out of 20 at random, what is the probability that *(a)* all are graduates and *(b)* at least one is a graduate? 6+6=12

Or

Does correlation always signify causal relation between two variables? Compute Karl Pearson's coefficient of correlation in the following data : 4+8=12

X	2	4	6	8	10
Y	5	7	9	8	11

SECTION—B

Answer any *two* of the following :

6. What do you mean by linear programming? Describe the basic characteristic of a linear programming problem. Define the terms 'feasible solution' and 'optimum solution'.

3+6+6=15

7. *(a)* What do you understand by the probability of an event? Explain its importance in economics.

(b) Three coins are tossed once. Write the sample space.

4+8+3=15

8. What do you understand by time series? Discuss the ratio to trend method for measuring seasonal variation in a time series. Mention its merits and demerits.

3+6+6=15

9. What is a wholesale price index? Construct the wholesale price index numbers for 2017 and 2018 from the data given below. Use 2010 as base year : 5+10=15

Wholesale Price (in ₹)

Item	*2010*	*2017*	*2018*
Rice	58	77	73
Wheat	36	55	77
Pulses	20	25	30
Fish	100	140	150
Oil	15	16	20

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ECO : SE–H 507

5th Semester Exam., 2022 (November)

ECONOMICS

(Honours)

SEVENTH PAPER

(Quantitative Methods for Economic Analysis)

Full Marks : 100

Pass Marks : 35

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Write very short answers of the following : 3×3=9

(a) How does a parameter differ from a constant? Illustrate with examples from economic analysis.

(b) Define derivative of a function.

(c) At what point, the two lines of regression intersect?

2. Write short answers of the following : 5×5=25

(a) Indicate the importance of statistics and mathematics in economics.

(b) Three coins are tossed simultaneously. Obtain the probability distribution of the number of heads on them.

(c) What is meant by splicing of index numbers? Illustrate your answer with the help of an example.

(d) Show that the production function $Q = Ak^{\alpha}L^{1-\alpha}$ is a linear homogeneous function.

(e) Mention the advantages of Spearman's rank correlation over Pearson's coefficient of correlation.

3. From the data given below, calculate—

(a) the correlation coefficient;

(b) the regression equation : 6+6=12

X	:	2	4	6	8	10
Y	:	5	7	9	8	11

Or

If

$$A = \begin{bmatrix} 1 & 2 & 1 \\ 5 & 2 & 3 \\ 1 & 1 & 1 \end{bmatrix}$$

then verify that

$$A(\text{adj } A) = |A| I = (\text{adj } A) A$$

The notations have their usual meanings. 4+4+4=12

4. Describe briefly the four components of a time series. Fit a linear trend to the following data by method of least squares : 6+6=12

Year	:	2016	2017	2018	2019	2020
Production (in 1000 tons)	:	80	90	92	83	94

Or

State the addition and multiplication theorems of probability. Give two different examples illustrating the application of these theorems. 6+6=12

5. Distinguish between Laspeyres' and Paasche's price index. Calculate Laspeyres' and Paasche's price indices for the year 2020 with 2015 as the base from the following data : 4+8=12

Commodities	*Quantities*		*Price per Unit*	
	2015	*2020*	*2015*	*2020*
A	8	6	2	4
B	10	5	5	6
C	14	10	4	5
D	19	13	2	2

Or

Given the utility function $U = (x+2)(y+1)$ and the budget constraint $2x + 5y = 51$, find the values of x and y that maximise the utility by using Lagrangian multiplier method. Check the second-order condition for maximum of utility. 8+4=12

6. Calculate the mean and the median of the frequency distribution given below : 5+5=10

Class Limit	*Frequency*
0–10	5
10–20	10
20–30	25
30–40	30
40–50	20
50–60	10

7. Define independent and mutually exclusive events. Can two events be mutually exclusive and dependent simultaneously? 5+5=10

8. What is the difference between correlation and regression analysis? Write the uses of regression analysis. 5+5=10

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