Your Roll No. ....

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M.Com./Sem. I (NC)   **F**

Paper 4101 : Business Statistics

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Time : 3 *Hours*   *Maximum Marks* : 100

(Write your Roll No. on the top immediately on receipt of this question paper.)

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Attempt *All* questions.

All questions carry equal marks.

All parts of a question must be attempted

together and in sequence.

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1.   (*a*)   For each of the following, state the events created in terms

of whether they are mutually exclusive or not and

collectively exhaustive or not :

(*i*)   Respondents in a survey are classified by the type

of car they drive : sedan, hatchback and SUV.

(*ii*)   A roll of a dice results in an even or odd number.

(*iii*)   People are asked if they live on the first floor, or second floor of their building.

(*iv*)   Registered voters in Delhi were asked if they voted for the Congress, BJP or AAP.   8

(*b*)   XYZ Ltd. has come under considerable pressure to eliminate its discriminatory hiring practices. Company officials have agreed that during the next five years, 60% of their new employees would be females and 30% will be black. One out of four new employees, though will be white males. What percentage of black females are they committed to hiring ?   6

(*c*)   A realtor is trying to sell a large piece of property. She believes there is a 0.90 probability that the property will

be sold in the next 6 months if the local economy

continues to improve throughout the period, and a 0.50

probability the property will be sold if the local economy

does not continue its improvement during the period. A

state economist consulted by the realtor believes there

is a 0.70 chance the economy will continue its improvement

during the next 6 months. What is the probability that

the piece of property will be sold during the period ?   6

Or

(d) Explain the classical approach to the study of probability

theory. What are its shortcomings ? Suggest an

alternative approach to overcome the shortcomings of the

classical approach.   6

(e) An investment analyst collects data on stocks and notes

whether or not dividends were paid and whether or

not stock increased in price over a given period. The
following data is available :

	Price Increase	No Price Increase	Total
Dividends paid	34	78	112
No dividends paid	85	49	134
Total	119	127	246

(i)   If a stock is selected at random, what is probability
       that it increased in price ?

(ii)   What is the probability that a stock that increased
       in price paid dividends ?

(iii) If a stock is known not to have paid dividends,
       what is the probability that it did not increase in
       price ?

(iv)   What is the probability that a stock increased in
       price or paid dividends or did both ?   8

(*f*) A regional director responsible for business development is concerned about the number of small business failures. If the mean number of small business failures per month is 10, what is the probability that less than four small businesses will fail during a given month ? Assume that probability of a failure is the same for any two months and that the occurrence or non-occurrence of a failure in any month is independent of failures in any other month.   6·

2. (*a*) What are the conditions for using a binomial distribution ? Under what conditions can the Poisson distribution be used as an approximation to the binomial distribution ?   6

(*b*) A bank that employs many part-time tellers is concerned about the increasing number of errors made by the tellers.

To estimate the proportion of errors made in a day, a random sample of 400 transactions on a particular day was checked. The proportion of the transactions with errors was computed. If the true proportion of transactions that had errors was 6% that day, what is the probability that the estimated proportion is less than 5% ?   7

(c) How many test runs of an automobile are required for determining its average miles per gallon rating on the highway to within 2 miles per gallon with 95% confidence, if the variance of the population of miles per gallon is known to be about 100% ? Will the answer change if the level of confidence is 90% ?   7

Or

(d) Under what circumstances do we use the *t*-distribution ? State the properties of *t*-distribution.   6

(e) The final marks in a statistics course are normally distributed with a mean of 70 and standard deviation of 10. The professor must convert all marks to letter grades. She decides that she wants 10% A's, 30% B's, 40% C's, 15% D's, and 5% E's. Determine the cutoffs for each letter grade. . .   7

(f) It is known that the amount of time needed to change the oil on a car is normally distributed with a standard deviation of 5 minutes. The amount of time to complete a random sample of 10 changes was recorded and listed here. Compute the (a) 99% confidence interval, and (b) 90% confidence interval estimate of the mean of the population :   7

11 10 16 15 18 12 25 20 18 24.

3.   (a)   Distinguish between stratified and cluster sampling. Give

examples also.   8

(b)   In a particular organization, employees have complained

that the soft drink vending machine A dispenses less drink

than machine B. To test this belief, several samples were

taken and weighed carefully, with the following

results :

Machine	Sample size	Sample mean	Sample standard deviation
A	40	5.38	1.59
B	32	5.92	0.83

Does this evidence support the hypotheses that the mean

amount dispensed by A is less than the amount dispensed

by B, at the 5% level of significance.   12

Or

(*c*)   Distinguish between a lower-tailed and an upper-tailed test.

Give examples also.   8

(*d*)   An article reports that smaller firms seem to be hiring more than large ones as the economy picks up its pace. The table below gives the number of employees hired and those laid off, out of a random sample of 1,032 firms, broken down by firm size. Is there evidence that hiring practices are dependent on firm size ? ($\alpha = 0.05$)   12

	Small firm	Medium-size firm	Large firm	Total
Number hired	210	290	325	825
Number laid-off	32	95	80	207
Total	242	385	405	1032

4.   (a)   Distinguish between parametric and non-parametric tests.

Compare the conditions under which we should use

parametric and non-parametric tests.   8

(b)   An investor has a certain amount of money available to

invest. Three alternative investments are available. The

estimated profits (in Rs.) of each investment under each

economic condition are indicated in the following payoff

table :

	Investment Selection		
Event	A	B	C
Economy declines	500	−2000	−7000
No Change	1000	2000	1000
Economy expands	2000	5000	20000

Based on his past experience, the investor assigns the

following probabilities to each economic condition :

P(Economy declines) = 0.30

P(No change) = 0.50

P(Economy expands) = 0.20

(i)   Determine the best investment according to the

Expected Monetary Value (EMV) criterion.

(ii)   Make the Expected Opportunity Loss Table.

(iii)   Explain the meaning of Expected Value of Perfect

Information (EVPI) in this problem.   12

Or

(c)   What is an estimator and an estimate ? Explain the

two types of estimates. Which one would you prefer and

why ?   8

(d)   Manufacturers of perishable foods often use preserva-

tives to avoid food spoilage. One concern is that too much

preservative will change the flavor of the food. Suppose

an experiment is conducted using samples of a food

product with varying amounts of preservative added. Both

length of time until the food shows signs of spoiling and

a taste rating are recorded for each sample. The taste rating

is the average rating for three tasters, each of whom rates

each sample on a scale from 1(good) to 5(bad). Twelve

sample measurements are shown. Using Spearman's rank

correlation coefficient, find out if an increase in the number

of days until spoilage is associated with a fall in taste

rating. (Significance level = 10%)   12

Sample	Days until spoilage	Taste Rank
1	30	4.6
2	47	3.6
3	26	4.5
4	94	2.8

5	67	3.3
6	83	2.7
7	36	4.2
8	77	3.9
9	43	3.6
10	109	2.2
11	56	3.1
12	70	2.9

5. (a) What do you understand by Type I and Type II errors in hypotheses testing ? Explain giving examples to support your answer. 8

(b) Attempting to analyse the relationship between advertising and sales, the owner of a furniture store recorded the monthly advertising budget (thousands of rupees) and

the sales (lakhs of rupees) for a sample of 12 months.
The data is as follows :

Advertising (X)	23	46	60	54	28	33
Sales (Y)	9.6	11.3	12.8	9.8	8.9	12.5
Advertising (X)	25	31	36	88	90	99
Sales (Y)	12.0	11.4	12.6	13.7	14.4	15.9

(i)   Calculate the least squares line and interpret the coefficients.

(ii) Determine the standard error of estimate.

(iii) Compute the coefficient of determination and interpret this value.   12

Or

(c) Distinguish between coefficient of determination and coefficient of correlation.   8

(d) A marketing research firm surveyed passengers from four different airlines regarding their level of satisfaction with

the services of the airlines. Scores were obtained and the

higher the score, the greater the level of satisfaction. Below

is the sample information.

Singapore Airlines	Lufthansa	US Airways	Thai Airways
94	75	70	68
90	68	73	70
85	77	76	72
80	83	78	65
	88	80	74
		68	65
		65	

Is there a difference in the mean satisfaction level among

the four airlines ? Use a significance level of 1%.   12