[This question paper contains 12 printed pages.]

7261 *Your Roll No.* .....

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

Paper 4101 : Business Statistics

Time : 3 Hours *Maximum Marks : 100*

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

Attempt **all** *questions.*
All *questions carry equal marks.*
All parts of a question must be attempted together and in sequence.

1. (a) Distinguish between the classical and relative frequency approach to probability. Explain the advantages and disadvantages of both these approaches. (7)

   (b) The following table gives the number of claims at a large health insurance company by kind and by geographic region.

	East	South	North	West
Hospitalisation	75	128	29	52
Physician's visit	233	514	104	251
Outpatient treatment	100	326	65	99

P.T.O.

Compute the probabilities of the following events :

(i) A randomly chosen bill is either from North or South.

(ii) A bill for hospitalisation is from South.

(iii) A randomly chosen bill is either from East or for outpatient treatment.

(iv) A bill from West is for the physician's visit.

(v) A randomly chosen bill is for hospitalisation.

(vi) A bill for outpatient treatment is from West.

(vii) A randomly chosen bill is for hospitalization or physician's visit. (7)

(c) The probability that a new product will be successful if a competitor does not come up with a similar product is 0.67. The probability that the new product will be successful in the presence of a competitor's new product is 0.42. The probability that the competing firm will come out with a new product during the period in question is 0.35. What is the probability that the product will be a success ? (6)

OR

(d) Explain marginal, joint and conditional probabilities under conditions of (i) statistical independence and (ii) statistical dependence. (6)

(e) An analyst develops the following table of joint probabilities relating the size of firm (measured in terms of number of employees) and type of firm.

Number of employees	*Industry*		
	Construction	**Manufacturing**	**Retail**
Under 20	0.2307	0.0993	0.5009
20-99	0.0189	0.0347	0.0876
100 or more	0.0019	0.0147	0.0113

If one firm is selected at random, find the probability of the following events :

(i) a firm employs fewer than 20 employees.

(ii) a firm is in the retail industry.

(iii) a firm in the construction industry employs between 20 and 99 workers.

(iv) a firm in the retail industry employs less than 20 workers.

(v) a firm is in construction or manufacturing industry.

(vi) a firm with 100 or more employees is in retail.

(vii) a firm employs 20-99 employees. (7)

(f) Suppose that the amount of time teenagers spend weekly working at part-time jobs is normally distributed with a standard deviation of 40 minutes. A random sample of 15 teenagers was drawn and each reported the amount of time spent at part-time jobs (in minutes). These are listed here. Determine the 95% confidence interval estimate of the population mean.

180	130	150	165	90	130	120	60
200	180	80	240	210	150	125	

(7)

2. (a) State the characteristics of the t-distribution. (6)

(b) An author's computer has too many softwares as a result of which the computer crashes on average once per week. If the number of crashes is Poisson distributed, (i) find the probability that the computer will not crash at all over the next 2 weeks, (ii) find the probability that the computer will crash at most once in the next two weeks. (7)

(c) The time needed to complete a final examination in a particular college course is normally distributed with a mean of 80 minutes and a standard deviation of 10 minutes.

(i) What is the probability that a student will complete the exam in more than 60 minutes but less than 75 minutes ?

(ii) Assume that the class has 60 students and that the examination period is 90 minutes in length. How many students do you expect will be unable to complete the exam in the allotted time ? (7)

OR

(d) Distinguish between a point estimate and an interval estimate. Which one would you prefer for estimating a population parameter and why ? (6)

(e) Typing speed on a new kind of keyboard for people at a certain stage in their training program is approximately normally distributed. The probability that the speed of a given trainee will be greater than 65 words per minute is 0.45, The probability that the speed will be more than 70 words per minute is 0.15. Find the mean and the standard deviation of typing speed. (7)

(f) A survey of 611 office workers investigated telephone answering practices, including how often each office worker was able to answer incoming telephone calls and how often incoming telephone calls went directly to voice mail. A total of 281 office workers indicated that they never need voice mail and are able to take every telephone call.

(i) What is the point estimate of the proportion of the population of office workers who are able to take every telephone call ?

(ii) What is the 90% confidence interval for the proportion of the population of office workers who are able to take every telephone call ?

(iii) How would your answer in (ii) change if the confidence level is 95% ? (7)

3. (a) Distinguish between a one-tailed and a two-tailed test. Give examples also. (8)

(b) A test is being designed to compare the wearing quality of two brands of tyres. Six cars were randomly selected, equipped with one tyre of brand

A and one tyre of brand B (the other two tyres are not part of the test) and driven for one month. The Table below gives the amount of wear (in thousandths of an inch) that took place in such a test.

Tyre brand	Car					
	1	2	3	4	5	6
A	125	64	94	38	90	106
B	133	65	103	37	102	115

Do the sample data provide sufficient evidence for us to conclude that the two brands show unequal wear, at 5% level of significance ? (12)

OR

(c) Explain the relevance of 'level of significance' in hypotheses testing. (8)

(d) The number of accidents per day in a particular city is believed to have a Poisson distribution. A sample of 120 days during the past year gives the following data. Do these data support the belief that the number of accidents per day has a Poisson distribution ? (Use α=0.05)

Number of accidents	Observed frequency (days)
0	39
1	30
2	30
3	18
4	3

(12)

4. (a) Explain the least squares method of finding the regression line. (8)

(b) A management consultant wants to test if there are differences in attitudes towards managers who hold MBA degrees. The consultant designed a study that recorded the attitude towards the same group of 17 managers before and after these completed an MBA programme, on a scale of 1 to 5 (5 being the highest). Use the sign test to see if there is a difference in attitude towards managers following the award of an MBA degree. (Test at a significance level of 1%).

Manager	Attitude before MBA	Attitude after MBA
1	3	4
2	5	5
3	2	3
4	2	4
5	4	4
6	2	3
7	1	2
8	5	4
9	4	5
10	5	4
11	3	4
12	2	5
13	2	5
14	2	3
15	1	2
16	3	2
17	4	5

(12)

OR

P.T.O.

(c) What are non-parametric tests ? Explain with examples. What are the advantages and disadvantages of non-parametric tests ? (8)

(d) Critics of television often believe that watching television reduces the amount of physical exercise in children causing weight gain. A sample of 15 children was taken and the number of ponds each child was overweight was recorded (a negative number indicates that the child is underweight). Additionally, the number of hours of television viewing per week was also recorded. The data is given below.

Hours of TV viewing per week	42	34	25	35	37	38	31	33
Overweight	18	6	0	–1	13	14	7	7
Hours of TV viewing per week	19	29	38	28	29	36	18	
Overweight	–9	8	8	5	3	14	–7	

(i) Find out the least squares regression line and describe what the coefficients tell you about the relationship between the two variables.

(ii) Compute the coefficient of determination and explain its meaning.

(iii) Determine the standard error of estimate. (4+4+4=12)

5. (a) Explain the properties of a good estimator. (8)

(b) An author is trying to choose between two publishing companies that are competing for the marketing rights to her new novel. Company has offered the author Rs. 10,000 plus Rs. 2 per book sold. Company B has offered the author Rs. 2,000 plus Rs. 4 per book sold. The author believes that five levels of demand for the book are possible: 1,000; 2,000; 5,000; 10,000 and 50,000 books sold.

(i) Construct a payoff table, indicating the events and alternative courses of action.

(ii) Construct an opportunity loss table. (12)

OR

(c) Explain the concept of Expected Value of Perfect Information (EVPI). What is the importance of EVPI in decision making ? (8)

(d) To test whether the mean time needed to mix a batch of materials is the same for machines produced by 3 manufacturers, a chemical company obtained the following data on the time (in minutes) needed to mix the material. Use these data to determine whether the population mean times for mixing a batch of material differ for the 3 manufacturers ? (Use α=0.05)

Manufacturer

1	2	3
20	28	20
26	26	19
24	31	23
22	27	22

(12)