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G 6316

M.E. DEGREE EXAMINATION, MAY/JUNE 2007.

First Semester

CAD/CAM/Industrial Engineering/Industrial Safety Engineering

MA 1605 — PROBABILITY AND STATISTICS

(Regulation 2005)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

Use of statistical tables is permitted.

PART A — (10 × 2 = 20 marks)

1. Write the classical definition of probability.
2. Define a random variable and its expectation.
3. What is the 'principle of least squares'?
4. How the estimators are obtained in the method of moment?
5. What do you mean by 'sampling distributions'?
6. Define Analysis of Variance.
7. Distinguish between completely randomised design and randomised block design.
8. What is the purpose of factorial design?
9. Mention any two uses of Time Series Analysis.
10. What is meant by 'Auto Regressive Process'?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Define a Poisson distribution and obtain its moment generating function.
- (ii) A manufacturer, who produces medicine bottles, finds that 0.1% of the bottles are defective. The bottles are packed in boxes containing 500 bottles. A drug manufacturer buys 100 boxes from the producer. Using Poisson distribution find how many boxes will contain (1) no defective (2) at least two defectives.

Or

- (b) (i) Define 'Normal distribution' and state its properties.
- (ii) Distinguish between correlation and regression co-efficients and indicate their relationship.
- (iii) In a partially destroyed laboratory, record of an analysis of correlation data, the following results only are legible :

$$\text{Regression equations : } 8X - 10Y + 66 = 0$$

$$40X - 18Y = 214$$

Variance of $X = 9$. Find the correlation co-efficient between X and Y .

12. (a) (i) What do you understand by the estimation of parameters?
- (ii) What are the characteristics of a good estimator?

(iii) Explain briefly the principle of least squares.

Or

(b) (i) Describe the method of maximum likelihood estimation.

(ii) If n_1 trials are conducted of Bernoullian type following binomial distribution, find the maximum likelihood estimate of p .

(iii) From the data relating to the yield of dry bark (X_1) height (X_2) and girth (X_3) for 20 cinchona plants the following correlation co-efficients are obtained.

$r_{12} = 0.77$, $r_{23} = 0.52$, and $r_{13} = 0.72$. Find $r_{12.3}$ and $R_{1.23}$.

13. (a) (i) Describe the essential steps involved in testing of hypothesis.

(ii) A machine puts 16 imperfect articles in a sample of 500. After it is overhauled, it puts out 3 imperfect articles in a batch of 100. Has the machine been improved? Use 1% level of significance.

(iii) A random sample of 15 from a normal universe gives a correlation co-efficient of -0.5 . Is this significant of the existence of correlation in the population. Use 5% level of significance.

Or

(b) (i) Describe the uses of χ^2 test.

(ii) The following table shows the lives in thousand hours of four batches of electric lamps.

Batches			
I	II	III	IV
16.0	15.8	14.6	15.1
16.1	16.4	15.5	15.2
16.5	16.4	16.0	15.3
16.8	17.0	16.2	15.7
17.0	17.5	16.4	16.0
17.2		16.6	16.8
18.0		17.4	
		18.2	

Perform analysis of variance and comment on your results. Use 1% level of significance.

14. (a) (i) Explain the three basic principles of experimental design.

(ii) The response time in milliseconds was determined for three different types of circuits that could be used in an automatic valve shut off mechanism. The results were as follows.

Circuit type	Response time				
I	9	12	10	8	15
II	20	21	23	17	30
III	6	5	8	16	7

Test whether the response times of three circuit types are homogeneous or not? Use 5% level of significance.

Or

(b) (i) What are the advantages and disadvantages of a Latin square design?

(ii) A company manager wants to purchase cars for its own use. He has to select the make of the car out of the four makes A, B, C and D available in the market. For this he tries four cars of each make by assigning the cars to four drivers to run on four different routes. For this, he chooses a Latin-Square design. The efficiency of cars is measured in terms of time in hours. The layout and time consumed is as given below :

Routes	Drivers			
	1	2	3	4
1	18 (C)	12 (D)	16 (A)	20 (B)
2	26 (D)	34 (A)	25 (B)	31 (C)
3	15 (B)	22 (C)	10 (D)	28 (A)
4	30 (A)	20 (B)	15 (C)	9 (D)

Analyse the data and draw your conclusions. Using 1% level of significance.

15. (a) (i) Define a time series and explain the various components of time series.

(ii) Fit a straight line trend by the method of least squares to the following data. Assuming that the same rate of change continues, what would be the predicted earnings for the year 1985?

Year :	1976	1977	1978	1979	1980	1981	1982	1983
Sales :	76	80	130	144	138	120	174	190

Or

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(b) (i) Describe the various steps involved in the moving average method for ascertaining the trend. Mention its advantages and disadvantages.

(ii) Estimate the trend for the following time series by the method of moving averages (4 yearly) :

Year	Tonnage of goods
1981	2204
1982	2500
1983	2360
1984	2680
1985	2424
1986	2634
1987	2904
1988	3098
1989	3172
1990	2952
1991	3248
1992	3172