M.E. DEGREE EXAMINATIONS: DECEMBER – 2008

First Semester

P07MA102 PROBABILITY AND STATISTICS

(Common to Industrial Engineering & CAD/CAM Branches)

Time: Three Hours   **Maximum Marks: 100**

Answer ALL Questions:-

PART A (20 x 1 = 20 Marks)

1. For two random variables X and Y, the relation $E[XY] = E[X] E[Y]$ holds hood

    a) if X and Y are statistically independent.   b) for all X and Y

    c) if X and Y are identical   d) if X and Y are correlated

2. E(4X-1) is

    a) 5E(X)   b) 3E(X)   c) 4E(X)   d) 4E(X)-1

3. The normal distribution is a limiting case of Poisson distribution when parameter.

    a) $\lambda \to 0$ b) $\lambda \to \sigma$ c) $\lambda \to \infty$ d) $\lambda < \sigma$

4. If two variables are uncorrelated then the regression lines

    a) coincident   b) are parallel to each other

    c) are perpendicular to each other   d) are same

5. The regression coefficients are b_1 and b_2. Then the correlation coefficient r is

    a) b_1/b_2 b) b_2/b_1 c) $b_1 b_2$ d) $\pm\sqrt{b_1 b_2}$

6. The two lines of regression are given as X + 2Y – 5 = 0 and 2X + 3Y = 8. Then the mean values of X and Y respectively are

    a) 2, 1   b) 1, 2   c) 2, 5   d) 2, 3

7. $R_{1.23}$ is

    a) $R_{1.23} > r_{12}, r_{23}$ b) $R_{1.23} > r_{23}, r_{13}$ c) $R_{1.23} > r_{13}, r_{12}$ d) $R_{1.23} > r_{12}, r_{13}, r_{23}$

8. $R_{2.13}$ lies between

    a) [0,1]   b) (0,1)   c) (-1,1)   d) [-1,1]

9. $r_{12.3}^2 =$

    a) $b_{12.3} \times b_{21.3}$ b) $b_{13.2} \times b_{21.3}$ c) $b_{12.3}/b_{21.3}$ d) $b_{13.2}/b_{21.3}$

10. Producer's risk is the stage of

    a) Type I error   b) Type II error   c) Sampling error   d) Standard error

11. Consumer's risk is the size of

    a) Type I error   b) Type II error   c) Sampling error   d) Standard error

12. Critical value depends upon

 a) The level of significance used
 b) The alternative hypothesis, whether it is two-tailed or single tailed
 c) The level of significance used and the alternative hypothesis, whether it is two-tailed or single tailed
 d) The null hypothesis, whether it is two-tailed or single tailed

13. Basic principles of Experimental design

 a) randomization, replication, local control
 b) completely randomized design, randomized block design
 c) ANOVA
 d) Latin square design

14. The main aim of the design of experiments is

 a) To control the extraneous variables
 b) To minimize the experimental error
 c) Both (i) & (ii)
 d) Either (i) or (ii)

15. In LSD (Latin Square Design), the number of replications of each treatment is

 a) equal to the number of treatments
 b) less than the number of treatments
 c) greater than the number of treatments
 d) not equal to the number of treatments

16. Elements of Time series are

 a) Secular Trend, Cyclical Variations
 b) Seasonal Variations, Erratic Variations
 c) Secular Trend, Seasonal Variations, Irregular Variations
 d) Secular Trend, Seasonal Variations, Cyclical Variations, Irregular Variations

17. Measurement of trend will help us to know

 a) Seasonal factor   b) Cyclical factor
 c) Irregular factor   d) all of the above

18. Seasonal changes during a particular year is called

 a) Specific seasonal index   b) Average
 c) Trend Value   d) Average trend value

19. in classical time series analysis, four components of Time Series analysis are assumed as

 a) $T \times S \times C \times I$ b) $T + S + C + I$ c) $T = S = C = I$ d) $T \neq S, S = C, C \neq I$

20. If one regression coefficient is greater than unity, then the other must be

 a) greater than the first one   b) equal to unity   c) less than unity   d) equal to zero

PART B (5 x 16 = 80 Marks)

21. a) (i) For the normal distribution show that all odd order moments about mean vanish.
                                                                        (8 marks)

(ii) X and Y are random variables with mean zero and standard deviation unity. The coefficient of correlation between $(aX + bY)$ and $(bX + aY)$ is $\dfrac{1+2ab}{a^2 + b^2}$. Find the coefficient of correlation between X and Y. (8 marks)

(OR)

b) If the joint distribution function of X and Y is given by
$$F(x,y) = 1 - e^{-x} - e^{-y} + e^{-(x+y)}, \ x > 0, \ y > 0$$
$$= 0 \qquad \text{if not}$$

a) Find marginal densities of X and Y.

b) Are X and Y independent?

c) Find $P(X \leq 1 \cap Y \leq 1)$ and $P(X + Y \leq 1)$.

22. a) Find the Maximum likelihood estimate for the parameter λ of a Poisson distribution on the basis of a sample of size n. Also find its variance. Show that the sample mean $\bar{x}$ is sufficient for estimating the parameter λ of the Poisson distribution.

(OR)

b) (i) If r_{12} and r_{13} are given, show that r_{23} must lie in the range

$$r_{13}r_{12} \pm \left(1 - r_{12}^2 - r_{13}^2 + r_{12}^2 r_{13}^2\right)^{1/2}.$$ (8 marks)

(ii) Show that the correlation coefficient between the residuals $x_{1.23}$ and $x_{2.13}$ is equal and opposite to that between $x_{1.3}$ and $x_{2.3}$. (8 marks)

23. a) (i) The heights of 10 males of a given locality are found to be 175, 168, 155, 170, 152, 179, 175, 160, 160 and 165 cm. Based on this sample, find the 95% confidence limits for the height of males in that locality. (8 marks)

(ii) Twelve dice were thrown 4096 times and throw of 6 was considered a success. The observed frequencies were as given below.

No. of successes:	0	1	2	3	4	5	6	7 & above
Frequency:	447	1154	1180	796	380	115	25	8

Test whether the dice were unbiased. (8 marks)

24. a) A company manager wants to purchase cars for his 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 Latin-Square design. The efficiency of cars are 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 comment on your results. Use 1% level of Significance.

(OR)

b)   Describe the randomized block design. Give the ANOVA table used. Enumerate the advantages of a RBD over a CRD.

25. a) (i) 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

   (8 marks)

(ii) Explain briefly the concept of moving averages and estimate the trend for the following time series by the method of   moving averages (4 yearly):

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

   (8 marks)

(OR)

b) (i) What are the advantages and limitations of moving average method? (8 marks)

(ii) Assuming that trend is absent, determine if there is any seasonality in the data give below.

Year	I Quarter	II Quarter	III Quarter	IV Quarter
1976	3.7	4.1	3.3	3.5
1977	3.7	3.9	3.6	3.6
1978	4.0	4.1	3.3	3.1
1979	3.3	4.4	4.0	4.0

What are the seasonal indices for various quarters?   (8 marks)

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