Reg. No.												

Question Paper Code	12136

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B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2023

Second Semester

Computer Science and Business Systems

20BSMA203 - STATISTICAL METHODS WITH LABORATORY

(Regulations 2020)

Duration: 3 Hours | Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

		Marks, K-Level, CO
1.	The coefficient of correlation between two variables X and Y is 0.48. The covariance is 36. The variance of X is 16. Find the standard deviation of Y.	*2,K2,CO1*
2.	Define positive and negative correlation.	*2,K1,CO1*
3.	Define critical region.	*2,K1,CO2*
4.	What are the applications of F-test?	*2,K1,CO2*
5.	Mention the properties of good estimator.	*2,K1,CO3*
6.	State Neymann Factorization theorem.	*2,K1,CO3*
7.	Differentiate between Parametric and Non Parametric test.	*2,K2,CO4*
8.	In sign test for paired data, when we can approximate binomial to normal distribution? Also write the SE and two limits of acceptance at 5% level of significance.	*2,K2,CO4*
9.	When a time-series does is said to be a strictly stationary?	*2,K1,CO5*
10.	Write the main stages in setting up a Box-Jenkins forecasting model.	*2,K1,CO5*

PART - B (5 × 16 = 80 Marks)

Answer ALL Questions

11. a) The heights of mothers and daughters are given in the following table. *16,K3,CO1*

(i) The two regression equations.

(ii) The co-efficient of correlation between the height of the daughter and mother.

(iii) Estimate height of the daughter when the height of the mother is 64.5 inches.

Height of the mother (inches)	62	63	64	64	65	66	68	70
Height of the daughter (inches)	64	65	61	69	67	68	71	65

OR

b) A company appoints four salesmen A, B, C and D and observes their sales in three seasons: summer, winter and monsoon. The figures (in lakhs of Rs.) are given in the following table. *16,K3,C*

		Salesman			
		A	B	C	D
Seasons	Summer	45	40	38	37
	Winter	43	41	45	38
	Monsoon	39	39	41	41

Carry out analysis of variance for significant difference between
(i) Salesman (ii) Seasons.

12. a) (i) Before an increase in excise duty on tea, 800 people out of a sample of 1000 were consumers of tea. After the increase in duty, 800 people were tea drinkers in a sample of 1200 people. Find whether there is a significant decrease in the consumption of tea after the increase in excise duty. *6,K3,CO*

(ii) Test if the difference in the means is significant for the following data: *10,K3,CO*

Sample I	76	68	70	43	94	68	33	
Sample II	40	48	92	85	70	76	68	22

OR

b) (i) The time taken by workers in performing a job by method I and method II is given below: *12,K3,CO*

Method I	20	16	26	27	23	22	
Method II	27	33	42	35	32	34	38

Do the data show that the variances of time distribution from population from which these samples are drawn do not differ significantly?

(ii) The Mean breaking strength of the cables supplied by a manufacturer is 1800, with a standard deviation of 100. By a new technique in the manufacturing process, it is claimed that the breaking strength of the cable has increased. To best this claim, a sample of 50 cables is tested and it is found that the mean breaking strength is 1850. Can we support the claim at 1% LOS? *4,K3,CO2*

13. a) (i) Show that $\bar{X}$ is consistent estimator of μ in $N(\mu, \sigma^2)$. *12,K3,CO3*

(ii) An automobile repair shop has taken a random sample of 40 services that the average service time on an automobile is 130 minutes with standard deviation of 26 minutes. Compute the standard error of the mean. *4,K3,CO3*

OR

b) (i) Find the maximum likelihood estimate for the parameter λ of a Poisson distribution on the basis of a sample size n. *12,K3,CO3*

(ii) Show that sample mean $\bar{X}$ is an unbiased estimator of the population mean μ. *4,K3,CO3*

14. a) (i) In a study of sedimentary rocks, the following data were obtained from samples of 32 grains from two kinds of sand : *10,K3,CO4*

Sand I	63	17	35	49	18	43	12	20	47	136	51
	45	84	32	40	44	25					
Sand II	113	54	96	26	39	88	92	53	101	48	89
	107	111	58	62							

Apply Mann-Whitney U test with suitable null and alternative Hypotheses.

(ii) In an industrial production line items are inspected periodically for (defectives. The following is a sequence of defectives items (D) and non- defective items (N) produced by these production line. *6,K3,CO4*

DD NNN D NN DD NNNNN DDD NN D NNNN D N D

Test whether the defectives are occurring at random or not at 5% level of significance.

OR

b) (i) Three different methods of advertising a commodity was used and the respective samples of sizes 9, 10 and 10 identical outlets were taken. The increased sales were recorded as follows. *10,K3,CO4*

Sample I	92	79	77	93	99	93	71	87	98	
Sample II	95	76	84	85	89	90	72	82	68	83
Sample III	81	91	75	80	78	94	100	86	88	69

Use Kendal concordance test to test the hypothesis that mean increase in sales due to three methods is same at 5% level of significance.

(ii) Apply the K-S test to check that the observed frequencies match with the expected frequencies which are obtained from Normal distribution. *6,K3,CO4*

Test Score	: 25-30	31-36	37-42	43-48	49-54	55-60	61-66
Obs. frequencies :	9	22	25	30	21	12	6
Exp. frequencies :	6	17	32	35	18	13	4

15. a) (i) Show that the acf of the second-order MA process *8,K3,CO5*

$$X_t = Z_t + 0.7Z_{t-1} - 0.2Z_{t-2}$$

is given by

$$\rho(k) = \begin{cases} 1 & k = 0 \\ 0.37 & k = \pm 1 \\ -0.13 & k = \pm 2 \\ 0 & \text{otherwise} \end{cases}$$

(ii) Find the ψ weights and π weights for the ARMA (1,1) process given by *8,K3,CO5*

$$X_t = 0.5X_{t-1} + Z_t - 0.3Z_{t-1}$$

OR

b) (i) For the model $(1-0.2B)(1-B)X_t = (1-0.5B)Z_t$ *8,K3,CO5*

(a) Classify the model as a ARIMA (p,d,q) process (i.e. find p,d,q).

(b) Determine whether the process is stationary and invertible

(ii) Explain in detail the classifications of forecasting methods. *8,K3,CO5*