



QP CODE: 25047658



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Reg No :

Name :

M.Sc DEGREE (CSS) EXAMINATION, NOVEMBER 2025

Third Semester

MSc Statistics with Data Science

Core Course - ST040303 - STATISTICAL COMPUTING 3 USING R AND PYTHON

2020 ADMISSION ONWARDS

21355060

Time: 3 Hours

Weightage: 30

(Answer any THREE questions. Each question carries a weight of 10)

1. The data in the following table gives the results of an experiment for comparing 7 treatments in 7 blocks of 3 units each, there thus being 3 replications of each treatment. Analyse the data :

Treatments	Blocks						
	1	2	3	4	5	6	7
1	50	42	91				
2			118	94	94		
3	76			64		80	
4			72			53	31
5	44				65		54
6		102			119	92	
7		38		38			37

2. The following table gives the layout and the results of a 2³ factorial design laid out in 4 replicates. The purpose of the experiment is to determine the effect of different kinds of fertilizers: Nitrogen (N); Potash (K) and Phosphate (P) on potato crop yield.

Block I				Block II			
nk	kp	p	np	kp	p	k	nk
291	391	312	373	407	324	272	306
1	k	n	nkp	n	nkp	np	1
101	265	106	450	89	449	338	106
Block III				Block IV			
p	1	np	kp	np	nk	n	p
323	87	324	423	361	272	103	324
nk	k	n	nkp	k	1	nkp	kp
334	279	128	471	302	131	437	435

Analyse the data.





3.

Canton Supplies, Inc., is a service firm that employs approximately 100 individuals. Managers of Canton Supplies are concerned about meeting monthly cash obligations and want to develop a forecast of monthly cash requirements. Because of a recent change in operating policy, only the past seven months of data that follow are considered to be relevant.

Month	1	2	3	4	5	6	7
Cash Required (\$1000s)	205	212	218	224	230	240	246

1. Construct a time series plot. What type of pattern exists in the data.
2. Use Holt's linear exponential smoothing with $\alpha = 0.6$, and $\beta = 0.4$ to forecast cash requirements for each of the next two months.
3. Develop a linear trend equation to forecast cash requirements for each of the next two months.
4. Would you recommend using Holt's linear exponential smoothing with $\alpha = 0.6$, and $\beta = 0.4$ to forecast cash requirements for each of the next two months or the linear trend equation? Explain.

4.

Consider the following autocorrelation and partial autocorrelation coefficients using 500 observations for a weakly stationary series

Lag	ACF	PACF
1	0.307	0.307
2	-0.013	0.264
3	0.086	0.147
4	0.031	0.086
5	-0.079	0.049

- a. Determine which, if any, of the ACF and PACF coefficients are significant at the 5% level.
- b. Use both the Box-Pierce and Ljung-Box statistics to test the joint null hypothesis that the autocorrelation coefficients are jointly zero.
- c. What process would you tentatively suggest could represent the most appropriate model for this series?
- d. How could you estimate the model you suggest in part(c)?

5.

The following data describes measures on several variables corresponding to 6 plants.

Plant	Leaf length	Stem length	Leaf breadth	Stem breadth	Root length
1	12	32	6	11	75
2	40	34	7	13	73
3	30	35.5	5	12	76
4	50	42	6	14.5	77
5	12.8	39	8	14	78
6	13.2	38.5	7	16	74

Group the plants using cluster analysis.





6.

Four psychological tests were given to 32 men and 32 women. The mean vectors and pooled covariance matrix is

$$\bar{y}_1 = \begin{bmatrix} 15.97 \\ 15.91 \\ 27.19 \\ 22.75 \end{bmatrix} \text{ and } \bar{y}_2 = \begin{bmatrix} 12.34 \\ 13.91 \\ 16.66 \\ 21.94 \end{bmatrix} \quad S_p = \begin{bmatrix} 7.164 & 6.047 & 5.693 & 4.701 \\ 6.047 & 15.89 & 8.492 & 5.856 \\ 5.693 & 8.492 & 29.36 & 13.98 \\ 4.701 & 5.856 & 13.98 & 22.32 \end{bmatrix}$$

- Is the men profile parallel to women profile at 1% level?
- If the profiles appear to be parallel, test it for the level of profiles.
- Finally, if profiles are at the same level, test it for the coincidence of profile.

