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Question Paper Code: R2M09

B.E./B.Tech. DEGREE EXAMINATION, APRIL / MAY 2025

Second Semester

Computer Science And Business Systems

R21UMA209- STATISTICAL METHODS

(Regulations R2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. In one-way ANOVA, with the usual notation, the error degree of freedom is CO6- U
(a) $n - c$ (b) $c - 1$ (c) $c - n$ (d) $n - 1$
2. In one-way ANOVA, given $SSB = 2580$, $SSE = 1656$, $k = 4$, $n = 20$ then the value of F is _____. CO1- App
(a) 7.3 (b) 8.3 (c) 7.8 (d) 8.7
3. Estimate is the observed value of an: CO6- U
(a) Unbiased estimator (b) Estimator
(c) Estimation (d) Interval estimation
4. Neymann Fisher Factorization theorem is also known as. CO6- U
(a) Theorem of sufficient estimators (b) Rao Black-well theorem
(c) Estimator (d) None of these
5. The standard error of the proportion $p = 0.5$ and $n = 15$. CO3-App
(a) 0.234 (b) -0.234 (c) 0.129 (d) -0.129
6. Compare to parametric methods, the nonparametric methods are _____. CO6- U
(a) Less accurate (b) Less efficient
(c) Computationally easier (d) (b) and (c) but not (a)

7. A time series consists of _____. CO6- U
 (a) Short – term variations (b) Long – term variations
 (c) Irregular variations (d) All of the above
8. If the demand is 100 during October 2016, 200 in November 2016, 300 in December 2016, 400 in January 2017. What is the 3-month simple moving average for February 2017? CO4-App
 (a) 300 (b) 350 (c) 400 (d) Need more information
9. R was created by? CO6- U
 (a) Ross Ihaka (b) Robert Gentleman (c) Both A and B (d) Ross Gentleman
10. Data Frames are created using the? CO6- U
 (a) frame() function (b) data. frame() function
 (c) data() function (d) frame.data() function

PART – B (5 x 2= 10 Marks)

11. What are the uses of analysis of variance? CO6 U
12. If T is an unbiased estimator for θ , show that T^2 is a biased estimator for θ^2 . CO2 App
13. Find the standard error of the proportion $p = 0.6$ and $n = 20$. CO3 App
14. Define secular trend. CO6 U
15. Explain what is t-tests in R? CO5 App

PART – C (5 x 16= 80 Marks)

16. (a) The following data represent the number of units production per day turned out by different workers using 4 different types of machines. CO1- App (16)

		Machine Type			
Workers		A	B	C	D
	1	44	38	47	36
	2	46	40	52	43
	3	34	36	44	32
	4	43	38	46	33
	5	38	42	49	39

Test whether the five men differ with respect to mean productivity and test whether the mean productivity is the same for the four different machine types.

Or

(b) Analyse the following is a Latin square of a design

CO1- App (16)

B 90	E 80	C 134	A 112	D 92
E 85	D 84	B 70	C 141	A82
C 110	A 90	D 87	B 84	E 69
A 81	C 125	E 85	D 76	B 72
D 82	B 60	A 94	E 85	C 88

17. (a) (i) A random sample of 10 cadets of a centre is selected and measures their weights (in kg) which are given below: 48, 50, 62, 75, 80, 60, 70, 56, 52, 78. Determine an unbiased estimate of the average weight of cadets of the centre.

CO2- App (8)

- (ii) Let $X_1, X_2, X_3, \dots, X_n$ be a random sample from Bernoulli distribution:

CO2- App (8)

$$f(x, \theta) = \begin{cases} \theta^x (1 - \theta)^{1-x}, & x = 0, 1 \\ 0 & \text{otherwise} \end{cases}.$$

Show that $\prod_{i=1}^n X_i$ is sufficient estimator for θ .

Or

- (b) If the number of weekly accidents occurring on a mile stretch of a particular road follows Poisson distribution with parameter λ then find the maximum likelihood estimate of parameter λ on the basis of the following data:

CO2- App (16)

No. of accidents	0	1	2	3	4	5	6
Frequency	10	12	12	9	5	3	1

18. (a) (i) The following data are small random samples of results in 8 – cities.

CO3- App (8)

City I	15	18	17	14	18	10	12	16
City II	10	9	8	11	7	13	--	--
City III	21	20	22	14	23	16	24	--

Conduct the H – test to determine whether evidence exists that there are differences in these cities.

- (ii) The following data constitute a random sample of 15 measurement of the octane rating of a certain kind gasoline: 99.0 102.3 99.8 100.5 99.7 96.2 99.1 102.5 103.3 97.4 100.4 98.9 98.3 98.0 101.6. Using sign test for 98.6 at the 0.05 level of significance.

CO3- App (8)

Or

- (b) (i) The following data are a random sample of consumer's income and expenditure on certain luxury items. Compute the rank correlation coefficient and test for the existence in the population. CO3- App (8)

Income	28	41	39	52	14	53	45	35	41	36	39
Luxury items	10	23	50	45	63	74	62	57	69	73	80

- (ii) 40 people were selected at random in the following order MMFFFF FMFFM MFMMM MFFMM FMFFM MMMF FMFMM FFMMMMF. Assuming the population has 50% men and 50% women, is true that the people were selected at random? CO3- App (8)
19. (a) Compute the seasonal indices by ratio to moving average method for the following series: CO4- App (16)

year	I	II	III	IV
1993	321	348	348	348
1994	327	351	354	348
1995	342	359	381	345
1996	364	390	401	385

Or

- (b) The following table gives the population of India: CO4- App (16)

Year	1989	1990	1991	1992	1993	1994	1995	1996
population	76	80	130	144	138	120	174	190

Compute the trend values by using the equation $y = ab^x$. Draw a graph using trend values and estimate the population in 2000.

20. (a) (i) Write a R program to get the first 10 Fibonacci numbers. CO5- App (8)
(ii) Write a R program to find the maximum and the minimum value of a given vector. CO5- App (8)

Or

- (b) Write a R program to create an array of two 3x3 matrices each with 3 rows and 3 columns from two given two vectors. Print the second row of the second matrix of the array and the element in the 2nd row and 3rd column of the 1st matrix. CO5- App (16)

