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Question Paper Code: R4M25

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

Fourth Semester

Agricultural Engineering

R21UMA425- PROBABILITY, STATISTICS AND NUMERICAL METHODS

(Regulations R2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The Standard deviation of binomial distribution is 2 its variance is CO6- U
(a) 5 (b) 6 (c) 7 (d) 4
2. The total area under the curve in normal distribution is CO6- U
(a) 1 (b) 2 (c) 5 (d) 4
3. The degrees of freedom for Binomial distribution is CO6- U
(a) $(n-1)(n-2)$ (b) $n-2$ (c) $n-3$ (d) $n-1$
4. The Standard deviation of the sampling distribution of a statistics is known as CO6- U
(a) Error (b) Standard Error (c) minor Error (d) Major Error
5. If Calculated value of F is less than tabulated value of F then CO6- U
(a) H_0 Accepted (b) H_1 Rejected (c) H_2 Accepted (d) H_0 Rejected
6. SSE for one way design is CO6- U
(a) 0 (b) TSS-SSC (c) TSS-SSC-SSR (d) TSS-SSC-SSR-SSK
7. The n^{th} divided difference of n^{th} degree polynomial is CO6- U
(a) constant (b) variable (c) qual (d) unequal
8. Newton's forward interpolation formula used only for _____ intervals CO6- U
(a) equal (b) unequal (c) equal and unequal (d) none of these

9. Gaussian two point quadrature formula is exact for polynomials up to degree ____ CO6- U
 (a) 1 (b) 2 (c) 3 (d) 5
10. Truncation error in Simpson's rule is of the order _____ CO6- U
 (a) odd (b) even (c) 0 (d) unequal

PART – B (5 x 2= 10 Marks)

11. The mean and variance of a binomial variate are 8 and 6. Find $p(X \geq 2)$ CO1- App
12. The nine items of a sample have the following values 45,47,50,52,48,47,49,53,51. Does the mean of these values differ significantly from the assumed mean 47.5 CO2- App
13. Compare and contrast LSD and RBD. CO6- U
14. Calculate the Second order divided difference for the following data. CO4- App

x	2	5	10
y	5	29	109

15. Write down Romberg's formula for I_1 and I_2 as well as I_3 and I_4 CO5- App

PART – C (5 x 16= 80 Marks)

16. (a) (i) If the probability density function of a random variable is given CO1- App (8)
 by $f(x) = \begin{cases} ax, & 0 \leq x \leq 1 \\ a, & 1 \leq x \leq 2 \\ 3a - ax, & 2 \leq x \leq 3 \\ 0, & \text{Otherwise} \end{cases}$ then Compute the value of 'a' and the cumulative distribution function of X
- (ii) A random variable X has the p.d.f $f(x) = \begin{cases} 2x, & 0 < x < 1 \\ 0 & \text{Elsewhere} \end{cases}$ CO1- App (8)
 Find i) $p(x < 1/2)$ ii) $p(1/4 < x < 1/2)$ iii) $p(x < 3/4 | x > 1/2)$.
 Or
- (b) (i) For a binomial distribution the mean is 4 and variance is 2. Find CO1- App (8)
 the probability of getting i) atleast 2 Success ii) atmost 2 success
 iii) $p(5 \leq X \leq 7)$
- (ii) A binomial variable x satisfies the relation $9P(x=4)=p(x=2)$ when CO1- App (8)
 $n=6$. Find the parameter p of the binomial distribution

17. (a) (i) The table gives the number of aircraft accidents that occurred during the various days of the week. Test whether the accidents are uniformly distributed over the week. CO2-Ana (8)

Days	Mon	Tue	Wed	Thu	Fri	Sat
No.of. accidents	14	18	12	11	15	14

- (ii) From the following two sample values, Identify the sampling distribution find, if the variances are significantly different. CO2-Ana (8)

Sample 1	5	6	8	1	12	4	3	9	6	10
Sample 1	2	3	6	8	10	1	2	8		

Or

- (b) (i) The theory predicts the population of beans in the four groups A, B, C and D should be 9:3:3:1. In an experiment among 1600 beans, the numbers in the four groups were 882, 313, 287 and 118. Does the experimental result support the theory? CO2- Ana (8)

- (ii) Two independent samples of sizes 9 and 7 from a normal population had the following values of the variables. CO2- Ana (8)

Sample I	18	13	12	15	12	14	16	14	15
Sample II	16	19	13	16	18	13	15		

Identify the sampling distribution, Do the estimates of the population variance differ significantly.

18. (a) The following table shows the lives in hours of four brands of electric lamps. CO3- Ana (16)

Brand A	1610	1610	1650	1680	1700	1720	1800	
Brand B	1580	1640	1640	1700	1750			
Brand C	1460	1550	1600	1620	1640	1660	1740	1820
Brand D	1510	1520	1530	1570	1600	1680		

Analyze the given data perform an analysis of variance test the homogeneity of the mean lives of the four brands of lamps.

Or

- (b) Analyze the data given below and interpret the results. CO3- Ana (16)

A(13) B(09) C(21) D(07) E(06)
D(09) E(08) A(15) B(07) C(16)
B(11) C(17) D(08) E(10) A(17)
E(08) A(15) B(07) C(10) D(07)
C(11) D(09) E(08) A(11) B(15)

19. (a) (i) From the data given below, find the number of students whose weight lies between 60-70 CO4-App (8)

Weight in lbs	0-40	40-60	60-80	80-100	100-120
No. of Students	250	120	100	70	50

- (ii) Using Lagrange's interpolation formula calculate the profit in the year 2000 from CO4-App (8)

year	1997	1999	2001	2002
Profit (Rs.in lakhs)	43	65	159	248

Or

- (b) (i) Find $f(3)$ by Newton's divided difference formula for the data CO4- App (8)

X	-4	-1	0	2	5
Y	1245	33	5	9	1335

- (ii) Using Newton's backward interpolation formula find $f(4)$ CO4- App (8)

x	0	1	2	3
y	1	2	3	10

20. (a) (i) Calculate the first and second derivatives of y at $x = 4$ from CO5- App (8)

x	0	1	2	3	4
y	1	2.718	7.381	20.086	54.598

- (ii) Evaluate $\int_4^{5.2} \log_e x dx$ using (i) Trapezoidal rule (ii) Simpson's CO5- App (8)

$\frac{1}{3}$ rule with 6 sub intervals

Or

- (b) (i) Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Romberg's method correct to 4 decimal places. CO5- App (8)

- (ii) Evaluate $\int_0^1 \frac{1}{1+x^2} dx$ using two point Gaussian quadrature formula. CO5- App (8)