SHRIMATHI DEVKUNVAR NANALAL BHATT VAISHNAV COLLEGE FOR WOMEN
(AUTONOMOUS)
(Affiliated to the University of Madras and Re-accredited with 'A+' Grade by NAAC)
Chromepet, Chennai - 600 044.
M.Sc.Applicable Mathematics - END SEMESTER EXAMINATIONS - APRIL 2025
SEMESTER - II

20PAMET2002 - Mathematical Statistics

Total Duration : 2 Hrs. 30 Mins. Total Marks : 60

Section B

Answer any **SIX** questions $(6 \times 5 = 30$ Marks)

1. State and prove Chapman-Robbins inequality.
2. Let X_1, X_2, ..., X_n be a sample from $\mathcal{N}(\mu, \sigma^2)$. Find the method of moments estimator for (μ, σ^2).
3. Let X_1, X_2, ..., X_n be a random sample from PDF $f_\theta(x) = \dfrac{\theta}{x^2}$ if $0 < \theta \leq x < \infty$. Find an MP test of $\theta = \theta_0$ against $\theta = \theta_1$ $(\neq \theta_0)$.
4. Nine adults agreed to test the efficacy of a new diet program. Their weights (pounds) were measured before and after the program and found to be as follows:

Participant	1	2	3	4	5	6	7	8	9
Before	132	139	126	114	122	132	142	119	126
After	124	141	118	116	114	132	145	123	121

   Test the hypothesis that the diet is not effective.

5. The lifetimes (in hours) of samples from three different brands of batteries, Y_1, Y_2, and Y_3, were recorded, with the following results:

Y_1	40	30	50	50	30	
Y_2	60	40	55	65		
Y_3	60	50	70	65	75	40

   Test whether the three brands have different average life times.

6. State and prove Blackwell theorem.
7. Time taken by workers in performing a job are given below:

Method 1	20	16	26	27	23	22
Method 2	27	33	42	35	32	34

   Test whether there is any significant difference between the variances of time distributions.

Contd...

8. Find the Neyman-Pearson size α test of $H_0 : \theta = \theta_0$ against $H_1 : \theta = \theta_1$ $(\theta_1 < \theta_0)$, based on sample of size 1 from the PDF $f_\theta(x) = 2\theta_x + 2(1-\theta)(1-x)$, $0 < x < 1$, $\theta \in [0, 1]$.

Section C

I - Answer any **TWO** questions $(2 \times 10 = 20$ Marks)

9. State and prove Cramer-Rao inequality.
10. Obtain MLE μ and σ^2 of normal distribution.
11. State and prove Neyman-Pearson fundamental lemma.
12. A market analyst believes that there is no difference in preference of television viewers among the four Ohio cities of Toledo, Columbus, Cleveland, and Cincinnati. To test this belief, independent random samples of 150, 200, 250 and 200 persons were selected from the four cities and asked, "What type of program do you prefer most: mystery, soap, comedy, or news documentary ?" The following responses were recorded:

	City			
Program Type	**Toledo**	**Columbus**	**Cleveland**	**Cincinnati**
Mystery	50	70	85	60
Soap	45	50	58	40
Comedy	35	50	72	67
News	20	30	35	33
Sample size	150	200	250	200

To test the hypothesis that the proportions of viewers who prefer the four types of programs are the same in each city.

II - Compulsory question $(1 \times 10 = 10$ Marks)

13. The following table gives the yield (pounds per plot) of three varieties of wheat, obtained with four different kinds of fertilizers.

Fertilizer	**Variety of Wheat**		
	A	B	C
α	8	3	7
β	10	4	8
γ	6	5	6
σ	8	4	7

Test the hypothesis of equality in the average yields of the three varieties of wheat and the hypothesis that the four fertilizers are equally effective.

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