

**STATISTICS (OPTIONAL) PAPER-II**

**TIME ALLOWED: THREE HOURS**

**MAXIMUM MARKS: 100**

**NOTE:** Attempt all questions. Answers should be supported by working. Simple calculator is allowed. Statistical tables will be supplied.

1. (a) Write short note on the following:
- Sampling and non-sampling errors
  - Stratified sampling and cluster sampling
  - Judgment and quota sampling
  - Central limit theorem
  - Sampling distribution
- (b) A small poll of 100 voters chosen at random from all voters in a given district indicated that 55% of them were in favor of a particular candidate. Find the 95% confidence interval for the proportion of all the voters in favor of this candidate. (15,5)

**OR**

1. (a) State the desirable properties of point estimators
- (b) A population consists of the elements: 2, 4, 6 and 8. Another population consists of the elements: 3, 5, 7 and 9. Draw all possible samples of size 2 without replacement from each population. Calculate mean for each sample. Construct the sampling distribution of the difference between means of the two populations. Calculate standard error of the difference between sample means from the two populations. (5,15)
2. (a) Describe the role of statistics in Social and Economic Planning.
2. (b) Calculate total fertility rate, gross reproduction rate, and net reproduction rate: (10,10)

Age group	Female births in 1961 to mothers in each age group	Total births in 1961 to mothers in each age group	Female population 1961 in each age group	Probability of daughters surviving from birth to age group of mothers
15-19	9015	18670	394119	0.97417
20-24	36956	75651	335924	0.97131
25-29	33785	69048	313611	0.96827
30-34	22383	46193	351825	0.96438
35-39	11377	23559	372637	0.95866
40-44	3131	6409	334594	0.95000
45-49	226	456	321900	0.93642

3. (a) Fit a straight line to the data in the following table and find the trend values.

Year	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Data	19.0	20.6	20.1	20.7	21.5	23.4	24.7	23.8	24.5	23.3	21.6

- (b) State the problems in construction of index numbers
- (c) Determine Fisher's ideal index number for the dairy product in the following table for the year 1985 using 1980-1981 as base.

	Price (cents per kg)			Quantity (millions of Kg)		
	1980	1981	1985	1980	1981	1985
Milk	29.11	30.69	28.38	58410	60360	65320
Butter	306.5	325.6	310.4	520	558	567
Cheese	343.6	367.8	356.4	1082	1211	1297

(10,3,7)

4. (a) The following table shows measurements on the strengths of cables made from two different alloys, I and II. Determine whether there is a difference at the 0.05 significance level between cables of alloy I and alloy II by using some suitable nonparametric test.

Alloy I				Alloy II				
18.3	16.4	22.7	17.8	12.6	14.1	20.5	10.7	15.9
18.9	25.3	16.1	24.2	19.6	12.9	15.2	11.8	14.7

- (b) Seeds of four different types of corn are planted in five blocks. Each block is divided into four plots, which are then randomly assigned to the four types. Determine at 0.05 significance level whether the yields in bushels per acre, as shown in the following table, vary significantly with differences in (i) soil (i.e., the five blocks) and (ii) the type of corn.

	Types of corn			
	I	II	III	IV
Block A	12	15	10	14
Block B	15	19	12	11
Block C	14	18	15	12
Block D	11	16	12	16
Block E	16	17	11	14

- (c) Draw a layout of Latin Square Design for 5 treatments. (5,10,5)

5. (a) It is claimed that a new diet will reduce a person's weight by 4.5 kilograms on the average in a period of 2 weeks. The weights of 7 women who followed this diet were recorded before and after a 2-week period.

	Women						
	1	2	3	4	5	6	7
Weight before	58.5	60.3	61.7	69.0	64.0	62.6	56.7
Weight after	60.0	54.9	58.1	62.1	58.5	59.9	54.4

Test the manufacturer's claim by computing a 95% confidence interval for the mean difference in the weight. Assume the distribution of weight to be approximately normal.

- (b) In the past, the standard deviation of weights of certain 2 kg packages filled by a machine was 12.5g. A random sample of 20 packages showed a standard deviation of 16g. Is the apparent increase in variability significant at the 0.01 level?
- (c) The following table shows the number of students passed and failed by three instructors: Mr. X, Mr. Y, and Mr. Z. Test the hypothesis that the proportions of students failed by the three instructors are equal.

	Mr. X	Mr. Y	Mr. Z
Passed	50	47	56
Failed	5	14	8

- (d) Measurement of the diameters of a random sample of 200 ball bearing made by a certain machine during one week showed a mean of 8.24 mm and a standard deviation of 0.42 mm. Find the 99% confidence limits for the mean diameter of all the ball bearing. (6,4,5,5)

**OR**

5. (a) Calculation on the weight of 12 fathers and their eldest sons gave the results:  $\sum X=800$ ,  $\sum Y=811$ ,  $\sum XY=54107$ ,  $\sum X^2=53418$ ,  $\sum Y^2=54849$ . Test the hypothesis that the regression coefficient of Y on X is 0.18. Use 5% level of significance.
- (b) A small poll of 200 voters chosen at random from all voters in a given district indicated that 105 of them were in favor of a particular candidate. How large a sample of voters should we take in order to be 99% confident that the candidate will be elected? (15,5)