KAKATIYA UNIVERSITY, WARANGAL

B.Sc. (STATISTICS) PRACTICAL EXAMINATIONS PROCEDURE

(With effect from Academic year 2008-2009) **(NEW REGULATION)**

1. Duration of Practical Examination: 3 hours.
2. Maximum marks: 50.
3. **FIVE** questions are to be set, taking **ONE** question from each section from the given question bank.
4. Student is required to solve any **THREE** questions
5. The scheme of Valuation is as given below :

   (i) Formula and explanation of symbols --- (5 Marks)

   (ii) Tabular forms with circuit diagram wherever necessary- (5 Marks)

   (iii) Observations --- (15 Marks)

   (iv) Calculations and graphs --- (8 Marks)

   (v) Result --- (2 Marks)

   (vi) Viva-voce --- (5 Marks)

   (vii) Practical Record --- (10 Marks)

   TOTAL MARKS: ------ **(50 Marks)**

KAKATIYA UNIVERSITY
FACULTY OF SCIENCE
B. Sc. I – YEAR, PRACTICAL EXAMINATION
STATISTICS PAPER - I
(Descriptive Statistics and Probability Distributions)
(Question Bank for Practical Examinations)

Note: 1) **FIVE** questions to be set, taking **ONE** question from each section.
2) Student is asked to answer any **THREE** questions.

SECTION – A

1. Draw a Histogram and frequency polygon from the following data:

Marks	0 – 10	10 – 20	20 – 40	40 – 50	50 – 60	60 – 70	70 - 90	90 - 100
No. of Students	4	6	14	16	14	8	16	5

2. Draw a Histogram and frequency polygon from the following data:

Monthly wages in Rs.	10 – 13	13 – 15	15 – 17	17 – 19	19 – 21	21 – 23	23 – 25
No. of Students	6	53	85	56	21	16	8

3. Draw 'less than' and 'more than' Ogives' from the data give below:

Profits	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80–90	90-100
(Rs. Lakhs)	6	8	12	18	25	16	8	5	2

4. Following information is obtained on the number of telephone calls made by 246 companies for the months of June and July 1999.

Telephone Calls	1000-1050	1050-1100	1100-1150	1150-1200	1200-1250	1250-1300	1300-1350	1350-1400
Companies	7	21	32	49	58	41	27	15

Construct (a) A more than O give (b) Less than O give

5. Following data relate to year – wise enrolment in a college classified according to sex. Draw a sub-divided Bar-diagram.

Telephones Calls	1990-1991	1991-1992	1992-1993	1993-1994	1994-1995
No. of Girls	810	825	844	780	820
No. of Boys	1215	1160	1325	1410	1480

6. The regional rainfall indices during the year 1986 to 1988 are give below.

Year	West	North	East	South	Centre
1988	78.4	88.9	83.7	89.9	86.5
1989	75.6	62.5	103.6	75.5	77.4
1990	121.2	116.5	107.6	123.9	90.3

Represent the data by multiple bar diagram.

7. a) Draw a suitable bar-diagram to represent the following data related to a school.

Year	1990	1991	1992	1993	1994	1995
No. of Students	210	242	290	315	340	355

b) Depict the following data by a suitable diagram (Balance of Trade=Export– Import)

Year	Export	Import
1993	98	115
1994	110	140
1995	115	96
1996	120	100

8. The growth of production of fish for the period 1950 – 51 to 1986 – 87 is give below. Represent the data by a suitable diagram.

Year	Marine	Inland
1950 – 51	5.34	2.18
1960 – 61	8.80	2.80
1970 – 71	10.86	6.70
1980 – 81	15.55	8.87
1984 – 85	16.98	11.03
1985 – 86	17.16	11.60
1986 – 87	12.47	8.42

9. Draw a pie diagram for the following data of six five-year plan public sector out lays.

1.	Agricultural and Rural Development	12.9%
2.	Irrigation etc.	12.5%
3.	Energy	27.2%
4.	Industry and Minerals	15.4%
5.	Transport, Communication etc,	15.9%
6.	Social Service and other	16.1%

10. The following data relates to the Expenditure (Rs.) of two families A and B. Draw a Multiple pie-diagram.

S. No.	Items of Expenditure	Family – A	Family – B
		Expenditure (Rs.)	Expenditure (Rs.)
1.	Food	1200	1700
2.	Clothing	500	800
3	House Rent	600	900
4	Fuel and Electricity	250	300
5	Miscellaneous	450	800

SECTION – B

11. a) Calculate the first four moments about the mean for the following data. Also calculate β_1 and β_2.

X	0	1	2	3	4	5	6	7	8
f	1	8	28	56	70	56	28	8	1

b). For a distribution the mean is 10, variance is 16, $\gamma_1 = +1$ and $\beta_2=4$ find the first four moments about the origin.

12. a) Calculate the first four central moments for the following data. Also calculate β_1 and β_2.

X	1	2	3	4	5	6	7	8	9
f	1	6	13	25	30	22	9	5	2

b) In a certain distribution the first four moments about the point 4 are -1.5, 17, -30, and 108, calculate the four moments about mean.

13. Calculate the values of μ_2, μ_3, μ_4, Hence find
i) A measure of skewness (β_1) (ii) a measure of Kurtosis (β_2) for the following distribution and comment on the nature of distribution.

Wages (In Rs.)	20–40	40–60	60–80	80-100	100–120	120–140	140–160	160–180
No. of Employees	6	9	11	14	20	15	10	8

14. From the following data calculate moments about

i) Assumed mean 25 ii) actual mean iii) moments about zero

Class	0 – 10	10 – 20	20 – 30	30 – 40
Frequency	1	3	4	2

15. Calculate the first four central moments for the following data and perform Sheppard's corrections.

Class Internal	10 – 15	15 – 20	20 – 25	25 - 30	30 – 35	35 – 40	40 – 45	45 – 50
Frequency	8	16	30	45	62	32	15	6

16. Given below is the distribution based on a random samples of 110 items from the production line of an industry. Calculate Sheppard's corrections.

Class Interval	100 – 105	105 – 110	110 – 115	115 – 120	120 – 125	125 – 130
No. of Employees	12	26	35	20	12	5

17. Calculate the first four moments about the origin zero and β_1 and β_2 coefficients for the following distribution of marks in statistics in an university examination. Also give your result about the symmetry of the distribution.

Marks	20 – 30	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80	80 – 90
No. of Students	14	27	39	48	36	12	4

18. Calculate Karl Pearson's Co-efficient of skweness and Bowley's coefficient of skewness for the following data.

C.I.	10 – 15	15 – 20	20 – 25	25 - 30	30 – 35	35 – 40	40 – 45	45 – 50
f	8	16	30	45	62	32	15	6

19. Obtain Karl Pearson's measure of skewness and Bowley's coefficient of skewness for the following data.

Class	5.5-10.5	10.5-15.5	15.5-20.5	20.5-25.5	25.5-30.5	30.5-35.5	35.5-40.5
Frequency	7	7	16	13	2	5	8

20. The daily expenditure of 100 families is given below:

Daily Expenditure	0 – 20	20 – 40	40 - 60	60 – 80	80 – 100
No. of families	13	?	27	?	16

If the mode of the distribution is 44, calculate the Karl Pearson coefficient of skewness.

SECTION – C

21. Fit a Binomial distribution for the following data using the direct method.

X	0	1	2	3	4	5	6	7
f	0	4	13	28	42	20	6	2

22. Seven coins are tossed and number of heads noted. The experiment is repeated 205 times and the following data is obtained.

No. of heads	0	1	2	3	4	5	6	7	8
Frequency	6	11	29	34	52	41	22	9	1

Using the direct method, fit a Binomial distribution when

1) The coin is unbiased 2) The nature of the coin is not known.

23. Seven coins are tossed and number of heads noted. The experiment is repeated 128 times and the following distribution is obtained.

No. of Heads	0	1	2	3	4	5	6	7
Frequency	7	6	19	35	30	23	7	1

Fit a Binomial distribution using recurrence formula, assuming that

(i) The coin is unbiased (ii) The nature of the coin is not known.

24. Fit a Binomial distribution for the data given below. Using recurrence method.

X	0	1	2	3	4	5	6	7	8
f	5	3	9	19	11	12	3	5	2

25. Fit a Poisson distribution using the direct method to the following data.

X	0	1	2	3	4	5
f	142	156	69	27	5	1

26. In 1000 consecutive issues of the 'utopian seven daily chronicle' the deaths of centenarians were recorded, the number x having the frequency 'f' according to the table. Fit a Poisson distribution by direct method.

X	0	1	2	3	4	5	6	7	8
f	229	325	257	119	50	17	2	1	0

27. The numbers of the phone calls received at on exchange in 245 successive one minute intervals are given in the following frequency distribution. Fit a Poisson distribution by recurrence method.

Number of calls	0	1	2	3	4	5	6	7
Frequency	14	21	25	43	51	40	39	12

28. Fit a Poisson distribution by recurrence method to the following data which gives the number of dodders in a sample of clover seeds.

No. of dodders (x)	0	1	2	3	4	5	6	7	8
Observed frequency	56	156	132	92	37	22	4	0	1

29. Fit a negative Binominal distribution and calculate the expected frequencies.

X	0	1	2	3	4	5
f	213	128	37	18	3	1

30. The number of accidents among 414 machines operators was investigated for three successive months. The following table gives the distribution of the operators according the number of accidents which happened to the same operators.

X	0	1	2	3	4	5	6	7	8
f	296	74	26	8	4	4	1	0	1

Fit a negative Binomial distribution.

31. For the following frequency distribution, Fit a Geometric distribution.

X	0	1	2	3	4	5
f	1	3	9	15	21	26

SECTION – D

32. Fit a normal distribution using Areas method for the following data.

Class	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80	80 – 90
Frequency	5	12	13	42	76	12	3	15

Also obtain the expected normal frequencies.

33. Fit a normal distribution to the following data by area's method.

Class	60 – 65	65 – 70	70 – 75	75 – 80	80 – 85	85 – 90	90 – 95	95 – 100
Frequency	3	21	150	335	326	135	26	4

34. Fit a normal distribution for the following data by ordinates method.

C.I.	150-160	160-170	170-180	180-190	190-200	200-210	210-220	220-230	230-240
f	9	24	51	66	72	48	21	6	3

35. Fit a normal distribution for the following data by the method of ordinates.

C.I.	60 – 62	63 – 65	66 – 68	69 – 71	72 – 74
F	5	18	42	27	8

36. Fit a normal distribution and obtain the expected frequencies by using any one of the methods for the following data.

C.I.	0 – 7	7 – 14	14 – 21	21 – 28	28 – 35	35 – 42	42 – 49
f	3	12	15	28	49	17	4

37. 200 electrical bulbs tested for the following data obtained. Fit an exponential distribution and draw graph for the observed and expected frequency.

C.I.	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100
f	104	56	24	12	4

38. The life time (in hours) of an I.C. of television set of a certain type is tested for 200 T.V. sets and recorded in the following frequency distribution.

Life time (in hrs)	0 – 30	30 – 60	60 – 90	90 – 120	120 – 150	150 – 180	180 – 210	210 – 240
Frequency	108	45	21	9	8	5	4	0

Fit an exponential distribution.

39. The waiting time X (in minutes) at a railway booking counter is exponentially distributed. The following distribution is obtained for 200 passengers.

Waiting time	0 – 5	5 – 10	10 – 15	15 – 20	20 – 25	25 – 30	30 – 35	35 – 40
No. of passengers	79	48	29	18	11	7	4	4

Fit an exponential distribution.

40. In air force operation, suppose a pilot-less helicopter is flying at 1 K.M. height from the origin. It has a sophisticated machine gun which identifies the enemy crossing the border and fires at him. It can uniformly turn in between $\left(\frac{-\pi}{2},\frac{\pi}{2}\right)$. It was reported that 200 terrorists were killed at different places along the border as given below. Fit a Cauchy distribution.

Distance	$-\infty$ to -25	-25 to -19	-19 to -13	-13 to -7	-7 to -1	-1 to -5	5 to 11	11 to 17	17 to 23	23 to $+\infty$
No. of terrorists killed	2	1	2	4	41	137	7	2	1	3

41. Fit a Cauchy distribution with location parameter 1.5 and scale parameter 1.

$-\infty$ to -15	17
-15 to -12	1
-12 to -9	3
-9 to -6	5
-6 to -3	15
-3 to 0	60
0 to 3	311
3 to 6	59
6 to 9	14
9 to 12	3
12 to 15	2
15 to ∞	16

SECTION – E

42. Draw the histogram for ungrouped data using MS EXCEL.

2.4	3.9	4.7	4.9	5.9	7.9	10.3
3.4	3.9	4.8	4.9	6.0	8.0	10.4
3.5	3.9	4.8	4.9	6.4	8.0	10.7
3.5	3.9	4.8	4.9	6.4	8.0	11.0
3.6	4.1	4.8	4.9	6.6	8.3	11.6
3.6	4.4	4.9	5.0	7.0	8.3	12.0
3.6	4.5	4.9	5.4	7.2	8.5	
3.8	4.6	4.9	5.8	7.4	8.6	
3.9	4.7	4.9	5.8	7.7	8.8	

43. Draw the Histogram for the grouped data using MS EXCEL.

C.I.	20-30	30-40	40-50	50-60	60-70	70-80	80–90
f	4	6	8	12	9	7	4

44. Draw the frequency polygon for the following data using MS-EXCEL.

Class	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80
Frequency	2	8	2	15	19	13	6	1

45. Draw the OGIVE curves for the following data using MS-EXCEL.

Class	10–15	15–20	20–25	25–30	30–35	35 – 4 0	40–45	45 – 50
Frequency	2	4	7	11	15	10	6	2

46. Following data relate to the year-wise enrolment of students in a college. Draw a simple Bar diagrams using MS-EXCEL.

Year	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88
Students Enrolments	100	175	250	225	300	350	400

47. Draw a sub-divided and multiple Bar-diagram using MS-EXCEL for the following data.

Year	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93
Boys	100	150	240	290	300	350
Girls	50	75	170	250	290	320

48. Draw a pie diagram using MS-EXCEL represent the following data showing the unit of electricity sold to different classes of consumers during a month by an electricity supplying company.

S. No.	Consumers Class	Percentage of Units Sold
1	Motive Power	40
2	Light & Fans	30
3	Domestic Supply	25
4	Street Light	5

49. Calculate measures of central tendency, dispersion and coefficients of skewness, kurtosis using MS-EXCEL for the following data.

Size (x)	4	5	6	7	8	9	10
Frequency	6	12	15	28	20	14	5

50. Calculate measures of central tendency, dispersion and coefficient of skewness, kurtosis using MS-EXCEL for the following data.

Class	20 – 25	25 - 30	30 – 35	35 – 40	40 – 45	45 – 50	50 – 55
Frequency	8	10	12	20	11	4	5

51. Fit a binomial distribution direct method using MS-EXCEL.

X	0	1	2	3	4	5	6	7
f	0	4	13	28	42	20	6	2

52. The distribution of typing mistakes committed by a typist is given below. Assuming a Poisson model find out the expected frequencies using MS-EXCEL.

Mistakes per page	0	1	2	3	4	5
No. of Pages	142	156	69	27	5	1

53. The study of divorced cases in the western countries, the following distribution is obtained for the time interval (in yeas) between the day of their marriages and the day of the their divorce. Fit an exponential distribution using MS-EXCEL.

No. of year	0 – 2	2 – 4	4 – 6	6 – 8	8 – 10	10 and Above
No .of Persons	126	48	17	6	2	1

54. Fit a Cauchy distribution for the following data using MS-EXCEL.

Distance	Observed frequency
$-\infty$ to -29	12
-29 to -21	10
-21 to -13	20
-13 to -5	38
-5 to 3	400
3 to 11	32
11 to 19	20
19 to 27	10
27 to 35	8
35 to $+\infty$	0

KAKATIYA UNIVERSITY
FACULTY OF SCIENCE
B. Sc. II - YEAR, PRACTICAL EXAMINATION
STATISTICS PAPER - II
(Statistical Methods and Inference)
(Question Bank for Practical Examinations)

Note: 1) **FIVE** questions to be set, taking **ONE** question from each section.
2) Student is asked to answer any **THREE** questions.

SECTION – A

1. Fit a straight line to the following data using the method of least squares and calculate expected values.

X	1	2	3	4	6	8
No. of Students	2.4	3	3.6	4	5	6

2. Fit a straight line by the method of least squares to the following data.

Year	1980	1981	1982	1983	1984	1985	1986
Production (1000 Qts)	80	90	92	83	94	99	92

3. Fit a parabola of second degree by the method of least squares to the following data.

X	0	1	2	3	4
Y	1	1.8	1.3	2.5	6.3

4. Fit a second degree parabola by the method of least squares method.

Year	1989	1990	1991	1992	1993
Sales	18	16	17	18	15

5. Fit an exponential curve of the form $y=ab^x$ to the following data by the method of least squares.

X	1	2	3	4	5	6	7	8
Y	1.0	1.2	1.8	2.5	3.6	4.7	6.6	9.1

6. Fit an Exponential curve of the form $Y = ab^x$ to the following data. By the method of least squares.

Year (X)	1951	1952	1953	1954	1955	1956	1957
Population (Y)	201	263	314	395	427	504	612

7. Fit an exponential curve of the form $Y=ae^{bx}$ to the following data. By the method of least squares.

X	2	3	4	5	6
Y	8.3	15.4	33.1	65.2	127.4

8. Fit an Exponential curve of the form $y=ae^{bx}$ to the following data. By the method of least squares.

Year (x)	1980	1981	1982	1983	1984	1985	1986	1987
Profit (y)	52	45	98	92	110	185	175	220

9. Fit a power curve $Y=ax^b$ for the following data and find the expected values.

X	1	3	4	7	8	9
Y	7	10	15	21	27	28

10. Investigate the association between darkness of eye-co lour in father and son from the following data:

Fathers with dark eyes and sons with dark eyes	50
Fathers with dark eyes and sons with not dark eyes	79
Fathers with not dark eyes and sons with dark eyes	89
Fathers with not dark eyes and sons with not dark eyes	782

Also tabulate for comparison the frequencies that would have been observed had there been no heredity.

11. The following table shows the association among 1,000 criminals between their weight and mentality. Calculate the coefficient of contingency between the two.

Weight in Pounds						
Mentality	110-120	120-130	130-140	140-150	Above 150	**Total**
Normal	50	102	198	210	240	**800**
weak	30	38	72	30	30	**200**
Total	**80**	**140**	**270**	**240**	**270**	**1000**

SECTION – B

12. Calculate the correlation co-efficient for the following height (in inches) of fathers (X) and their sons (Y)

X	65	66	67	68	69	70	72
Y	67	68	65	68	72	69	71

13. The following table give the frequency, according to grades and marks obtained by 67 students in an intelligence test. Measure the degree of relation ship between age and intelligence test.

Marks	**Age in years**				**Total**
	18	**19**	**20**	**21**	
200 – 250	4	4	2	1	**11**
250 – 300	3	5	4	2	**14**
300 – 350	2	6	8	5	**21**
350 – 400	1	4	6	10	**21**
Total	**10**	**19**	**20**	**18**	**67**

14. Ten competitions in a beauty contest are ranked by three judges in the following order.

1st Judge	1	6	5	10	3	2	4	9	7	8
2nd Judge	3	5	8	4	7	10	2	1	6	9
3rd Judge	6	4	9	8	1	2	3	10	5	7

Use the rank correlation coefficient to determine which pair of judges has the nearest approach to common tastes in beauty.

15. Suppose the observations on X and Y are give as:

X Statistics	59	65	45	52	60	62	70	55	45	49
Y Maths	75	70	55	65	60	69	80	65	57	61

Compute the least square regression lines of Y on X and X on Y. If a students gets 61 marks in statistics what would you estimate his marks in mathematics.

16. Following are the data pertaining to the production and export of sugar in lakh tones in India from 1971 to 1982.

Production (X)	37.4	31.1	38.7	39.5	47.9	42.6	48.4	64.6	58.4	38.6	51.4	84.0
Export (Y)	3.90	1.33	1.10	4.39	9.41	9.67	3.41	2.51	8.62	9.90	6.64	6.50

Find the regression lines of X on Y and Y on X. Also estimate export when production is 47.5 lakh tones.

17. Obtain the regression equation of Y on X and X on Y the value of 'r' from the following table giving the marks in accountancy and statistics.

Marks in Statistics	**Marks in accountancy**				
Y X	**5 – 15**	**15 – 25**	**25 – 35**	**35 – 45**	**Total**
0 – 10	1	1	-	-	**2**
10 – 20	3	6	5	1	**15**
20 – 30	1	8	9	2	**20**
30 – 40	-	3	9	3	**15**
40 – 50	-	-	4	4	**8**
Total	**5**	**18**	**27**	**10**	**60**

18. Compute partial correlation co-efficient for the following data.

X_1	4	5	7	9	13	15
X_2	15	12	8	6	4	3
X_3	30	24	20	14	10	4

19. The following data gives the weights (X_1) to the nearest pound, heights (X_2) to the nearest inches, and ages (X_3) to the nearest years of 12 boys data given below.

Weights (X_1)	64	53	71	67	55	58	77	57	56	51	76	68
Heights (X_2)	57	49	59	62	51	50	55	48	52	42	61	57
Age (X_3)	8	6	10	11	8	7	10	9	10	6	12	9

Compute multiple correlation coefficients.

20. Compute correlation ration η_{xy} from the following table.

Y ↓ **X** →	**10**	**15**	**20**	**25**
7	3	2	-	-
9	-	1	4	6
11	-	3	4	2
13	2	1	5	-
15	-	6	-	1

21. Calculate rank correlation coefficient for the following data.

X	68	64	75	50	64	80	75	40	55	64
Y	62	58	68	45	81	60	68	48	50	70

SECTION – C

22. a). A dice is thrown 9000 times and throw 3 or 4 observed 3240 times. Test whether the dice can be regarded as an unbiased one.

b). The means of two single large samples of 1000 and 2000 members are 67.5 inches and 68.0 inches respectively. Can the samples be regarded as drawn from the same population of standard deviation 2.5 inches? (Test at 5% l.o.s.)

23. a). A sample of 900 members as a mean 3.5 cms and standard deviation is 2.61 cms. Is the sample from a large population of mean 3.25cms and S.D. 2.61 cms. (α =5%)

b). Before an increase in excise duty on tea, 800 persons out of sample of 1000 persons were found to be tea drinkers. After an increase in duty, 800 people were tea drinkers in a sample of 1200 people. Test at $\alpha = 0.05$ whether there is a significant decrease in the consumption of tea after the increase in excise duty.

24. a). A coin is tossed 10,000 times and it turns up head 5,195 times. Test at 5% level of significance whether the coin can be treated as unbiased one.

b). The mean height of a random sample of size 100 individuals from a population 64.3 inches. The standard deviation of the sample is 2.7 inches. Would it be reasonable that the mean height of the population is 60 inches (Test at $\alpha = 0.01$.)

25. An insurance agent has claimed that the average age of policy holders who insure through him is less than the average for all agents, which is 30.5 years.

A random sample of 100 policy holders who had insured through him gave the following age distribution.

Age last Birthday	16 – 20	21 – 25	26 – 30	31 – 35	36 – 40
No. of persons	12	22	20	30	16

Calculate the arithmetic mean and S.D. of this distribution and use these values to test his claim at the 5% level of significance.

26. Random samples drawn from two countries gave the following data relating to the heights of adult males.

	Country A	**Country B**
Mean height in inches	67.42	67.25
S.D.	2.58	2.50
Number in Samples	1000	1200

a) Is the difference in means significant.

b) Is the difference in S.D. significant (use $\alpha = 0.05$)

27. The correlation between the price indices of animal feeding stuffs and home-grown cats in a sample of 60 members is 0.68 could the observed value have arisen.

a) From an uncorrelated population?

b) From a population in which true correlation was 0.8?

28. Prices of shares of a company of 10 days were found to be 66, 65, 69, 70, 69, 71, 70, 63, 64, 68 can be concluded that the prices of shares on an average is 65 ?

29. Below are given the gain in weights (in lbs) of pigs fed on two diets 'A' and 'B'.

Gain in Weight

Diet A	25	32	30	34	24	14	32	24	30	31	35	25			
Diet B	44	34	22	10	47	31	40	30	32	35	18	21	35	29	22

Test, if the two diets differ significantly as regards their effect on increase in weight.

30. 12 school boys were given a test in mathematics they were given a month of coaching and second test was held at the end of it. The marks recorded are as follows.

Boys	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Marks in Test – I	44	40	61	52	32	44	70	41	67	72	53	72
Marks in Test – II	53	38	69	57	46	39	73	48	73	74	60	78

Do the marks give the evidence that the students have been benefited by the extra coaching ?

31. It is believed that the precision (as measured by the variance) of an instrument is no more than 0.16. Write down the null and alternative hypothesis for testing this belief. Carry out the test at 1% level given 11 measurement of the same subject on the instrument.

2.5, 2.3, 2.4, 2.3, 2.5, 2.7, 2.5, 2.6, 2.6, 2.7, 2.5.

SECTION – D

32. Two samples are drawn from two normal population from the data information given below. Test whether the two samples have the same variance at 5% and 1% l.o.s.

Sample – I	60	65	71	74	76	82	85	87	-	-
Sample – II	61	66	67	85	78	63	85	86	91	88

33. a). In an experiment on pea breeding, Mendal obtained the following frequencies of seeds. 315 round and yellow, 101 wrinkled and yellow, 108 round and green and 32 wrinkled and green. Theory predicts that the frequencies would be in the proportion 9:3:3:1 does the experiment results support the theory ?

b). A survey of 320 families with 5 children each revealed the following distribution.

No. of Boys	5	4	3	2	1	0
No. of Girls	0	1	2	3	4	5
No. of Families	14	56	110	88	40	12

Is this result consistent with the hypothesis that male and female births are equally probable ?

34. The following table reveals the conditions of the house and the condition of the children.

Conditions of children	**Condition of house**		**Total**
	Clean	**Not Clean**	
Very Clean	76	43	**119**
Clean	38	17	**55**
Dirty	25	47	**72**
Total	**139**	**107**	**246**

At 5% l.o.s. find out whether the condition of house effects the condition of children.

35. The following table shows.

	Eye Colour in sons		
Eye colour in father		Not Light	Light
	Not light	230	148
	Light	151	471

Test whether the colour of sons's eye is associated with that of the father.

36. a) Test the randomness of the samples 8,4,6,3,9,12, 15, 6, 9, 13, 7 by using single sample run test.

b) Test the median equal to 20 of the population at 1% l.o.s.
15, 18, 22, 20, 16, 25, 28, 18, 19, 41, 21.

37. The following are the scores of certain randomly selected students at mid term and final examinations.

Mid term Score X	55	57	72	90	57	74	
Final Score Y	80	76	63	58	56	37	75

Apply 'run test' to test whether the distribution of scores at two occasions is same (use $\alpha = 0.05$)

38. Test the equality of two populations at 1% l.o.s. by using paired sign test.

Sample – I	2	8	6	7	9	6
Sample – II	3	5	9	6	10	4

39. Test the equality of population by using Median Test.

Sample – I	2	8	6	4	3	-
Sample – II	8	2	9	7	5	7

40. Test the equality of two populations at 1% l.o.s. by using mann-whitney wilcoxon signed rank test.

Sample – I	8	7	6	3	5	10	4	8	7
Sample – II	3	8	7	2	6	4	3	7	6

41. The data 10 plots each, under two treatments are as given below:

Treatment I	46	45	32	42	39	48	49	30	51	34
Treatment II	44	40	59	47	55	50	47	70	43	55

Apply an appropriate Non-parametric test to test whether the medians of two populations from which the above two sample have been chosen are same (use $\alpha = 0.05$).

SECTION – E

42. Generate the uniform random numbers between (0, 1) using MS-Excel.

43. Generate the uniform random numbers between (2, 5) using MS-EXCEL.

44. Generate the Poisson random numbers with parameters ($\lambda = 2$) using MS-Excel.

45. Generate the Exponential random numbers with parameter ($\theta = 2$) using MS-Excel.

46. Generate the standard normal random Numbers using MS-Excel.

47. Fit a straight line by least squares method using MS-Excel.

X	0	1	2	3	4	5
Y	2	5	8	11	14	17

48. Fit a second degree parabola to the following data using MS-Excel.

X	1	2	3	4	5	6	7	8	9
Y	2	6	7	8	10	11	11	10	0

49. Calculate Karl Pearson's coefficient of correlation for the following data using MS-Excel.

X	55	56	57	57	58	59	60	62
Y	57	58	55	58	62	62	59	61

50. Compute Regression line 'Y' on 'X' for the following data using MS-Excel.

X	55	56	57	57	58	59	60	62
Y	57	58	55	58	62	62	59	61

51. Compute partial correlation co-efficient for the following data using MS- Excel.

X_1	3	4	6	8	12	14
X_2	14	11	7	5	3	2
X_3	29	23	19	13	9	3

52 Compute multiple correlation co-efficient for the following data using MS-Excel.

X_1	62	51	69	65	53	56	75	55	54	49	74	66
X_2	55	47	57	60	49	48	53	46	50	40	59	55
X_3	6	4	8	9	6	5	8	7	8	4	10	7

53. An automatic machine was designed to pack exactly tow kilograms of oil. A sample of 100 tins was examined to test the machine. The average weight was found to be 1.94 kilogram with a standard deviation of 0.10 kilograms. Is machine working properly. Test using MS-Excel.

54. Two samples of 49 items each respectively gave the following data.

	Mean	S.D.
Sample I	49.77	4
Sample II	49.00	5

Is the difference of the means significant, at 5% l.o.s. ? Test using MS-Excel.

55. The height of 10 males of a given locality are found to be 70, 67, 62, 68, 61, 68, 70, 64, 64, 66 inches. It is reasonable to believe that the average height is greater than 64 inches? Test at 5% l.o.s. using MS-Excel.

56. The result of a survey to know the educational attainment among 100 persons, randomly selected is a locality, are given below.

EDUCATION

Sex	Middle school	High School	College
Male	10	15	25
Female	25	10	15

Can you say that education depend on Sex? Test using MS-Excel.

KAKATIYA UNIVERSITY
FACULTY OF SCIENCE
B.Sc. III-YEAR, PRACTICAL EXAMINATION
STATISTICS, PAPER- III
APPLIED STATISTICS
(Question Bank for Practical Examination)

Note:

1. FIVE questions to be set, taking **ONE** question from each section.
2. Student is asked to answer any **THREE** questions
3. Solutions to these problems are to be obtained using calculator/graph sheets/statistical tables and computer for MS-excel.

SECTION – A

1. Consider a population of 4 units with values 1, 2, 3, 4 write down all possible samples of size 2 (without replacement) from this population and verify that sample mean is an unbiased estimate of the population mean. Also calculate its sampling variance.

2. Consider a population of 6 units with values 1, 2, 3, 4, 5, 6 write down all the possible samples of 2 (without replacement) from this population and verify that:

   (i) Sample mean is an unbiased estimate of population mean.
   (ii) Sample mean square is an unbiased estimate of population Mean Square.
   (ii) Find it sampling variance and verify that this variance is less than the variance obtained from sampling with replacement.

3. In a pop with N=6,the values of Y_i are 8,3,11,1,4 and 7.Calculate the Sample Mean $\bar{y}$ for all possible Simple Random Samples without replacement of size 3 and show that:
   (i) $E(\bar{y}) = \bar{Y}$ (ii) $E(s^2) = S^2$

4. The number of diseased plants (out of 9) in 25 areas are in the following table:

S.No.of areas:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
No.of Diseased Plants:	1	4	1	2	5	1	1	1	7	2	3

12	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
3	2	2	3	1	2	7	2	6	3	5	3	4	5

Draw a simple random sample (without replacement) of 10 areas.

5. A sample of 30 students is to be drawn from a population consisting of 300 students belonging to two colleges A and B. the means and standard deviations of their marks are given below:

	Total Number of Students	**Mean**	**Standard Deviation**
College A	200	30	10
College B	100	60	40

How would you draw the sample using proportional allocation technique? Hence obtain the variance of estimate of the population mean and compare its efficiency with simple random sampling without replacement.

6. A population of size 800 is divided into 3 strata. Their sizes and standard deviations are given below:

	Strata		
	I	**II**	**III**
Size	200	300	300
S.D	6	8	12

A stratified random sample of size 120 is to be drawn from the population. Determine the sizes of samples from the three strata in case of

(i) Proportional allocation (ii) Neyman's optimum allocation.

7. There are 200 small industrial establishments in a city. The number of employees in each establishment in a simple random sample of 20 establishments is given below:

12	28	39	52	76	81	75	84	28	68
98	35	82	13	20	52	15	21	43	59

Estimate the average number of employees per establishment in the city and find the standard error of the estimate.

8. A sample survey is to be undertaken to ascertain the mean annual income of farms in certain area. The farms are stratified according to their principal products. A census conducted several years earlier gave the following information.

Types of Farm	**Number of Farms**	**Mean Annual Income**	**Standard Deviation**
Sheep	161	10946	2236
Wheat	195	6402	2614
Dairying	274	2228	606
Others	382	1458	230

For a sample of 12 farms compute the sample sizes in each stratum under:

(i) Proportion allocation and

(ii) Optimum allocation. Compare the precision's of these methods with that of simple random sampling.

9. The data below are for a small artificial population which exhibits a fairly steady rising trend. Each column represents a systematic sample and the rows are the strata Compare the precision of systematic sampling, random sampling and stratified sampling.

Strata	Systematic Sample Number									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
I	0	1	1	2	5	4	7	7	8	6
II	6	8	9	10	13	12	15	16	16	17
III	18	19	20	20	24	23	25	28	29	27
IV	26	30	31	31	33	32	35	37	38	38

10. The data given below are for a small artificial population which exhibits a fairly steady rising trend. Each column represents a systematic sample and the rows are the strata. Compare the precision of systematic sampling, random sampling and stratified sampling. Data for 10 systematic samples with n=4, k=10, N=nk=40.

Strata	Systematic Sample Number									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
I	1	2	2	2	3	4	5	7	9	10
II	10	11	11	15	16	16	17	18	19	22
III	22	20	20	20	20	24	27	20	30	30
IV	31	35	35	30	37	30	30	30	40	42

SECTION-B

11. A test was given to five students take at random from the fifth class of three schools of a town. The individual scores are

Schools	Students				
	A	**B**	**C**	**D**	**E**
I	9	7	6	5	8
II	7	4	5	4	5
III	6	5	6	7	6

Carry out the analysis of variance and state your conclusions.

12. The following table gives quality rating of service stations by five professional raters:

RATER	SERVICE STATION									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
A	99	70	90	99	65	85	75	70	85	92
B	96	65	80	95	70	88	70	51	84	91
C	95	60	48	87	48	75	71	93	80	93
D	98	65	70	95	67	82	73	94	86	80
E	97	65	62	99	60	80	76	92	90	89

Analyse the data and discuss whether there is any significant difference between ratings or between service stations.

13. A set of data involving four tropical feedstuffs A, B, C, D tried on 20 chicks is given below. All the 20 chicks are treated alike in all respects except the feeding treatments and each feeding treatment is given to 5 chicks. Analyse the data.

A	55	49	42	21	52
B	61	112	30	89	63
C	42	97	81	95	92
D	169	137	169	85	154

14. An experiment was carried out on wheat with three treatments in four randomized blocks. The plan and yield per plot in kgms are given below. Analyze the data and state the conclusions.

BLOCKS

I	II	III	IV
B (18)	A (80)	B (18)	B (18)
A (17)	B (72)	C (13)	C (27)
C (18)	C (18)	A (22)	A (45)

15. The following data gives yields (in qtls) of 5 varieties in a 4 block Randomized Block Design experiment. Carry out the ANOVA for

(i) Homogeneity of blocks

(ii) Homogeneity of varieties. Write your conclusion.

Varieities / Blocks	V_1	V_2	V_3	V_4	V_5
B_1	21	32	67	45	43
B_2	29	32	15	67	33
B_3	41	22	25	25	35
B_4	35	16	18	19	22

16. In the table below are the yields of 6 varieties in a 4 replicate experiment for which one value is missing. Estimate the missing value and analyze the data.

Blocks	**Varieties**					
	1	**2**	**3**	**4**	**5**	**6**
1	18.5	15.7	16.2	14.1	13.0	13.6
2	11.7	----	12.9	14.4	16.9	12.5
3	15.4	16.6	15.5	20.3	18.4	21.5
4	16.5	18.6	12.7	15.7	16.5	18.0

17. Consider the results given in the following table for an experiment involving six treatments in four randomized blocks. The treatments are indicated by numbers within parenthesis.

Blocks	**Treatment and yield**					
1	(1) 24.7	(3) 27.7	(2) 20.6	(4) 16.2	(5) 16.2	(6) 24.9
2	(3) 22.7	(2) 28.8	(1) 27.3	(4) 15.0	(6) 22.5	(5) 17.0
3	(6) 26.3	(4) 19.6	(1) 38.5	(3) 36.8	(2) 39.5	(5) 15.4
4	(5) 17.7	(2) 31.0	(1) 28.5	(4) 14.1	(3) 34.9	(6) 22.6

Test whether the treatments differ significantly. Also (i) Determine the critical difference between the means of any two treatments, and (ii) Obtain the efficiency of this design relative to its layout as C.R.D.

18. Setup the analysis of variance for the following results of Latin square design.

D (15.2)	A (22.7)	B (32.0)	C (16.2)
A (12.6)	D (32.9)	C (41.0)	B (62.3)
C (13.8)	B (14.2)	A (58.8)	D (62.0)
B (17.1)	C (31.7)	D (42.6)	A (38.8)

19. Estimate the missing value in the following Latin Square Design.

A (12)	C (19)	B (10)	D (8)
C (18)	B (12)	D (6)	-----
B (22)	D (10)	A (5)	C (21)
D (12)	A (7)	C (27)	B (17)

20. An experiment was carried out to determine the effect of claying the ground on the field of barley grains; amount of clay used were as follows:

A: No clay B: Clay at 100 per acre
C: Clay at 200 per acre D: Clay at 300 per acre

Column / Row	**1**	**2**	**3**	**4**
1	D 29.1	B 18.9	C 29.4	A 5.7
2	C 16.4	A 10.2	D 21.2	B 19.1
3	A 5.4	D 38.8	B 24.0	C 37.0
4	B 24.9	C 41.7	A 9.5	D 28.9

(i) Perform the ANOVA and calculate the critical difference for the treatment mean yields.
(ii) Calculate the efficiency of the above Latin Square Design over (a) R.B.D and (b) C.R.D.

SECTION-C

21. Below are given the figures of production (in thousand quintals) of a Sugar factory.

Year	1973	1975	1976	1977	1978	1979	1982
Production	77	88	94	85	91	98	90

Fit a straight line by the least squares method and tabulate the trend values.

22. Fit a second degree parabola to a given time series data. From the following production data.

Year	1971	1972	1973	1974	1975
Production	1	2.8	6.3	12.5	26.5

23. Fit a power curve to the given data below. By using method of least squares.

Years	1978	1979	1980	1981	1982
Sales in ('000Rs.)	10	12	13	10	8

24. You are given the population figures of India as follows.

Census year	1911	1921	1931	1941	1951	1961	1971
Population (In crores)	25.0	25.1	27.9	31.9	43.9	47.8	54.7

Fit an exponential trend $y = ab^x$ to the above data.

25. Calculate 4 years and 5 years moving average for the following data of number of commercial industrial failure in a country during
1985- 2000.

Year	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**
No. Of failure	23	26	28	32	20	12	12	10
Year	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
No. Of failure	9	13	11	14	12	9	3	1

26. Calculate seasonal variations for the following data of sales in thousand rupees of a firm by ratio to trend method.

Years	Quarters			
	Q_1	Q_2	Q_3	Q_4
1979	30	40	36	34
1980	34	52	50	44
1981	40	58	54	48
1982	54	76	68	62
1983	80	92	86	82

27. Calculate seasonal indices by ratio to moving average method for the following data.

Quarters	Years			
	1980	**1981**	**1982**	**1983**
Q_1	75	86	90	100
Q_1	60	65	72	78
Q_1	54	63	66	72
Q_1	59	80	85	93

28. From the following data calculate seasonal indices by Link Relative method.

Years	Quarters			
	Q_1	Q_2	Q_3	Q_4
1979	30	26	22	31
1980	35	28	22	36
1981	31	29	28	32
1982	31	31	25	35
1983	34	36	26	33

29. From the data given below construct the
    (i) Simple Index numbers and
    (ii) Laspeyer's, Paasche's and Fisher's price and Quantity Index numbers. (Using 1978 as the base year)

Commodity	1978		1982	
	Price	**Quantity**	**Price**	**Quantity**
A	2.00	4000	2.50	4500
B	5.00	500	4.00	800
C	1.50	1500	2.00	900
D	10.00	250	12.00	260
E	8.00	2500	5.50	500

30. Prepare price and quantity index numbers for 1993 with 1992 as base year from the following data by using.
(i) Laspeyer's, (ii) Paasche's and (iii) Fisher's

Year	Article I		Article II		Article III		Article IV	
	Price	**Quantity**	**Price**	**Quantity**	**Price**	**Quantity**	**Price**	**Quantity**
1992	5.00	5	7.75	6	9.63	4	12.50	9
1993	6.50	4	8.80	10	7.75	6	12.75	9

With reference to the above, prove how the factor Reversal Test and Time Reversal Test are satisfied by Fisher's Formula.

31. a). From the following data construct the cost of living index.

Group	Index number	Weights
Food	352	48
Fuel and lighting	200	10
Clothing	230	8
House rent	160	12
Miscellaneous	190	15

b). Construct the wholesale price index number for 1982 and 1983 from the data given below, using 1981 as the base year.

Commodity	Wholesale price (in rupees) per quintal		
	1981	**1982**	**1983**
A	140	160	190
B	120	130	140
C	100	105	108
D	75	80	90
E	250	270	300
F	400	420	450

32. Show that for the following series of fixed base index numbers, the chain indices are same as fixed base index numbers.

Year	**1972**	**1973**	**1974**	**1975**	**1976**	**1977**	**1978**	**1979**	**1980**	**1981**	**1982**
Index Number	100	120	122	116	120	120	137	136	149	156	137

33. From the index numbers given below, find out index numbers by shifting base from 1980 to 1983.

Year	**1980**	**1981**	**1982**	**1983**	**1984**	**1985**	**1986**
Index Number	100	76	68	50	60	70	75

34. Given below are two price Index series. Splice them on the base 1974=100.

Year	**Old price index for Steel base (1965=100)**	**New price index For steel base (1974=100)**
1970	141.5	
1971	163.7	
1972	158.2	
1973	156.8	99.8
1974	157.1	100.0
1975		102.3

35. The following table gives the annual income of a worker and the general index numbers of price during 1999 to 2007. Prepare index number to show the changes in the real income of the teacher and comment on price increase:

Year	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Income (Rs.)	36000	42000	50000	55000	60000	64000	68000	72000	75000
Price Index No.	100	120	145	160	250	320	450	530	600

SECTION-D

36. Compute the crude and standardized death rates of the two populations A and B regarding A as standard population, from the following data:

Age-Group (Years)	**A**		**B**	
	Population	**Deaths**	**Population**	**Deaths**
Under 10	20000	600	12000	372
10-20	12000	240	30000	660
20-40	50000	1250	62000	1612
40-60	30000	1050	15000	325
Above 60	10000	500	3000	180

37. Estimate the standardized death rates for the following countries:

Age-Group (In years)	Death rate per 1000		Standardized Population (In lakhs)
	Country A	Country B	
0-4	20.00	5.00	100
5-14	1.00	0.50	200
15-24	1.40	1.00	190
25-34	2.00	1.00	180
35-44	3.30	2.00	120
45-54	7.00	5.00	100
55-64	15.00	12.00	70
65-74	40.00	35.00	30
75 and above	120.00	110.00	10

38. Find the standardized death rate by direct and indirect methods for data given below.

Age	Standard population		Population A	
	Population	Specific Death rate	Population	Specific death rate
0-5	8000	50	12000	48
5-15	10000	15	13000	14
15-50	27000	10	15000	9
50 and above	5000	60	10000	59

39. Compute (i) G.F.R (ii) A.S.F.R (iii) T.F.R. from the data given below.

Age group of child Bearing females	**15-19**	**20-24**	**25-29**	**30-34**	**35-39**	**40-44**	**45-49**
Number of women ('000)	16.0	16.4	15.8	15.2	14.8	15.0	14.5
Total Births	260	2244	1894	1320	916	280	145

Assume the proportion of female births is 46.2%.

40. Calculate (i). G.F.R (ii). T.F.R (iii). G.R.R. from the following data, assuming that for every 100 girls, 106 boys are born.

Age of women	No. of women	Age-specific fertility rate Per (1,000)
15-19	212619	98.0
20-24	198732	169.6
25-29	162800	158.2
30-34	145362	39.7
35-39	128109	98.6
40-44	106211	42.8
45-49	86753	16.9

41. From the data given below, calculate the G.R.R and N.R.R.

Age-group	Number of children born to 1,000 women passing through the age-group	Mortality rate (Per 1000)
16-20	150	120
21-25	1500	180
26-30	2000	150
31-35	800	200
36-40	500	220
41-45	200	230
46-50	100	250

Sex ratio being males: female's 52:48.

42. If X is the age of a living being and l_x is the no. of living beings at age X, the following data is obtained for a creature in a forest construct life table of the living being:

X	0	1	2	3	4	5	6	7	8	9	10
$\mathbf{l_x}$	100	92	87	56	49	32	25	18	8	7	0

43. Fill in the blanks in a portion of life table given below:

Age in Years	l_x	d_x	p_x	q_x	L_x	T_x	e_x^0
4	95000	500	?	?	?	4850300	?
5	?	400	?	?	?	?	?

44. a). Given the following table for l_x, the number of rabbits living at age x, complete the life table for rabbits.

X	0	1	2	3	4	5	6
$\mathbf{l_x}$	100	90	80	75	60	30	0

b). If X, Y, Z are three rabbits of age 1,2 and 3 years respectively. Find the probability that at least one of them will be alive for one year more.

45. Below are given the year (t), the yearly per capita consumption of butter in kgs (d_t) and the real price (p_t) i.e. the nominal price divided by the consumer price index during the years 1 to 19.

T	$\mathbf{d_t}$	$\mathbf{p_t}$	**t**	$\mathbf{d_t}$	$\mathbf{P_t}$
1	12.16	1.92	11	18.44	1.25
2	12.63	1.62	12	18.85	1.21
3	13.46	1.76	13	18.77	1.27
4	14.12	1.74	14	19.11	1.40
5	14.94	1.67	15	19.91	1.34
6	15.34	1.51	16	20.38	1.30
7	15.65	1.47	17	20.44	1.42
8	17.04	1.44	18	20.20	1.46
9	17.62	1.37	19	20.44	1.48
10	18.04	1.30	----	----	----

Fit a demand curve of the form $d_t = cp_t^{-\alpha}$

SECTION – E

46. (i) A test was given to five students take at random from the fifth class of four schools of a town. The individual scores are:

Schools	**Students**				
	A	**B**	**C**	**D**	**E**
I	19	17	16	15	18
II	17	14	15	14	15
III	16	15	16	17	16
IV	18	17	16	19	17

Carry out the analysis of variance of one way classification by using MS-EXCEL.

(ii) A company has appointed four salesman, A, B,C, and D, and observed their sales in three seasons----summer, winter and monsoon. The figures (in lakh) are given in the following table:

Seasons	**Salesman**			
	A	**B**	**C**	**D**
Summer	36	36	21	35
Winter	28	29	31	32
Monsoon	26	28	29	29

Perform an analysis of variance on the above data by using MS- EXCEL.

47. A set of data involving four tropical feedstuffs A, B, C, D tried on 20 chicks is given below. All the 20 chicks are treated alike in all respects expect the feeding treatments and each feeding treatment is given to 5 chicks. Analyse the data by using MS-EXCEL

A	55	49	42	21	52
B	61	112	30	89	63
C	42	97	81	95	92
D	169	137	169	85	154

48. A varieties trial was conducted at a research station. The design adopted for the same was five randomized blocks of 6 plots each. The yields in lb. per plot obtained from the experiment are as under:

Blocks	**Varieties**					
	V_1	**V_2**	**V_3**	**V_4**	**V_5**	**V_6**
1	30	23	34	25	20	13
2	39	22	28	25	28	32
3	26	43	43	31	49	17
4	38	45	36	35	32	20
5	44	51	23	58	40	30

Analyze the design by using MS- EXCEL

49. Analyze the following Latin square design by using MS- EXCEL

Rows	**Columns**			
	C_1	**C_2**	**C_3**	**C_4**
R_1	A (22)	B (12)	C (32)	D (22)
R_2	B (26)	A (13)	D (18)	C (17)
R_3	C (18)	D (12)	A (22)	B (24)
R_4	D (12)	C (18)	B (14)	A (10)

50. a). Use the method of least squares to find the straight line trend for the following data by using MS-EXCEL.

Year	1987	1988	1989	1990	1991	1992
Sales	10	12	15	16	18	19

b). Fit a second degree parabola to the following data by using MS- EXCEL.

Years	1985	1986	1987	1988	1989	1990
Price	100	107	128	140	181	192

51. Using three year moving averages determine the trend for the following data using MS-EXCEL.

Year	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Production	21	22	23	25	24	22	25	26	27	26

52. Find seasonal variation by the ratio to trend method for the following data by using MS- EXCEL.

Year	**Quarters**			
	Q_1	**Q_2**	**Q_3**	**Q_4**
1982	15	20	18	17
1983	17	26	25	22
1984	20	29	27	24
1985	27	38	34	31
1986	40	46	43	41

53. Obtain seasonal indices by the ratio to moving average method for the following data by using MS-EXCEL.

Year	**Quarters**			
	Q_1	**Q_2**	**Q_3**	**Q_4**
1982	68	62	61	63
1983	65	58	66	61
1984	68	63	63	67

54. From the following data calculate seasonal indices by Link Relative method by using MS-EXCEL.

Year	**Quarters**			
	Q_1	**Q_2**	**Q_3**	**Q_4**
1979	30	26	22	31
1980	35	28	22	36
1981	31	29	28	32
1982	31	31	25	35
1983	34	36	26	33

55. Compute (i) Laspeyre's (ii) Paasche's and (iii) Fisher's price and quantity index numbers for the following data by using MS-EXCEL.

Articles	Base years (1982)		Current year (1984)	
	Price	Quantity	Price	Quantity
A	5	10	4	12
B	8	6	7	7
C	6	3	5	4

56. Construct a cost of living index from the following data by using MS-EXCEL, the weights being food 55, Rent 20, Clothing 15, fuel and lighting 15 and miscellaneous 5

Year	Food	Rent	Clothing	Fuel and Lighting	Miscellaneous
1985	100	100	100	100	100
1986	105	104	98	100	110
1987	110	112	102	101	115
1988	112	115	105	103	120

57. a). From the index numbers given below, find out index numbers by shifting base from 1970 to 1973 by using MS-EXCEL.

Year	1970	1971	1972	1973	1974	1975	1976
Index Number	200	86	78	60	70	80	95

b). Given below are two price Index series. Splice them on the base 1974=100 by using MS-EXCEL.

Year	Old price index for Steel base (1965=100)	New price index For steel base (1974=100)
1970	141.5	
1971	163.7	
1972	158.2	
1973	156.8	99.8
1974	157.1	100.0
1975		102.3

58. The following table gives the annual income of a worker and the general index numbers of price during 1999 to 2007. Prepare index number to show the changes in the real income of the teacher and comment on price increase by using MS-EXCEL.

Year	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Income (Rs.)	36000	42000	50000	55000	60000	64000	68000	72000	75000
Price Index No.	100	120	145	160	250	320	450	530	600

59. Compute (i). G.F.R (ii). A.S.F.R (iii). T.F.R. from the data given below by using MS-EXCEL

Age group of child Bearing females	**15-19**	**20-24**	**25-29**	**30-34**	**35-39**	**40-44**	**45-49**
Number of women ('000)	16.0	16.4	15.8	15.2	14.8	15.0	14.5
Total Births	260	2244	1894	1320	916	280	145

Assume the proportion of female births is 46.2%.

60. Given the following table for lx, the number of rabbits living at age x, complete the life table for rabbit by using MS-EXCEL.

X	0	1	2	3	4	5	6
$\mathbf{l_x}$	100	90	80	75	60	30	0

KAKATIYA UNIVERSITY
FACULTY OF SCIENCE
B.Sc. III – YEAR, PRACTICAL EXAMINATION
STATISTICS, PAPER-IV
(QUALITY, RELIABILITY AND OPERATIONS RESEARCH)

(Question Bank for Practical Examinations)

Note:

1. **FIVE** questions to be set, taking **ONE** question from each section.
2. Student is asked to answer any **THREE** questions.
3. Solutions to these problems are to be obtained using Calculators/Graph sheets/Statistical tables. Examination is conducted accordingly.

SECTION-A

1. Construct a control chart for mean for the following data on the basis of fuses, samples of 5 being taken every hour (each set 5 has been arranged in ascending order of magnitude) comment on whether the production seems to be under control, assuming that these are the first data.

42	42	19	36	42	51	60	18	15	69	64	61
65	45	24	54	51	74	60	20	30	109	90	78
75	68	80	69	57	75	72	27	39	113	93	94
78	72	81	77	59	78	95	42	62	118	109	109
87	90	81	84	78	132	138	60	84	153	112	136

2. Construct a control chart for mean for the following data (sample of 5 being taken every hour) comment on whether the production seems to be under control.

42	40	42	21	15	19	50	40	31	51	80	52	80
45	47	51	32	29	19	67	42	35	52	81	61	81
52	51	52	45	37	29	68	47	36	65	92	65	83
61	56	52	46	46	29	72	52	36	71	92	67	85
67	62	80	49	58	42	77	55	37	80	93	72	89

3. The following data give the measurements of the axles of bicycle wheels. 12 samples were taken so that each sample contains the measurements of 4 axles construct the control chart for range and comment whether the process is under control or not.

139	140	142	136	145	146	148	145	140	140	141	138
140	142	136	137	146	148	145	146	139	140	137	140
145	142	143	142	146	149	146	147	141	140	142	144
144	139	141	142	146	144	146	144	138	139	139	138

4. Construct the control chart for standard deviation (σ-chart) for the following data. On the basis of fuses samples of 4 being taken every hour. Comment on whether the production seems to be under control assuming that these are the first data.

27	30	21	40	51	33	30	35	20	22	34	32	34	28	44
23	17	44	21	34	30	22	48	34	50	22	48	32	30	32
36	27	22	29	17	28	18	20	15	45	36	32	28	17	22
24	32	28	24	10	22	12	47	42	41	44	33	38	23	41

5. The following are the figures of defectives in 22 lots each containing 2000 rubber belts: 425, 430, 216, 341, 225, 322, 280, 306, 337, 305, 356, 402, 216, 264, 126, 409, 193, 326, 280, 389, 451, 420. Draw control chart for fraction defective and comment on the state of control of the process.

6. The following are the figure of defectives in 30 lots each containing 1500 items. Draw the control chart for fraction defective (p-chart) and comment on the state of control process. 228, 313, 72, 610, 215, 128, 67, 100, 28, 315, 400, 118, 66, 226, 193, 280, 451, 420, 306, 356, 344, 225, 400, 190, 68, 7, 72, 818, 196, 300.

7. The following data give number of detectives in 10 independent samples of varying sizes from a production process.

Sample no.	1	2	3	4	5	6	7	8	9	10
Sample size	2000	1500	1400	1350	1250	1760	1875	1955	3125	1575
No. of defectives	425	430	216	341	225	322	280	306	337	305

Draw the control chart for fraction defective and comment on it.

8. Construct appropriate control chart.

Lot-Number	1	2	3	4	5	6	7	8	9	10
Number inspected	500	400	300	150	600	450	750	800	900	1000
No.of defectives	25	42	35	16	15	40	72	81	82	100

Estimate the process average fraction defective.

9. The following table gives inspection data on completed spark plugs and 10 Samples of 100 each being included. Construct the number of defects chart.

Sample No.	1	2	3	4	5	6	7	8	9	10
No. of defects	5	4	7	8	2	3	4	5	8	6

10. Assume that 20 liters milk bottles are selected at random from a process. The number of air bubbles (defects) observed from the bottles is given in the table. [c=No. of air bubbles (defects) in each bottle]

Bottle No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
No.of defects	4	5	7	3	3	5	6	2	4	8	3	5	4	3	4	5	3	7	6	13

SECTION-B

11. Draw the OC curve for the single sampling plan n=89 and c=2.

12. Suppose that a product is shipped in lots of size N=5000 the receiving inspection procedure used a single sampling with n=50 and c=1.Then draw the OC curve for the plan.

13. For the single sample plan N=2000, n=100, c=2 find the Probability of accepting the lot (P_a) when lot fraction defective P=0.005, 0.01, 0.05 0.10. Also draw an OC curve.

14. Draw the OC curve for a double sampling plan with n_1=50, c_1=1, n_2=100 and c_2=3.

15. Draw the OC curves for a double sampling plan with n_1=30, c_1=1, n_2=70, c_2=4 and N=2000. If the incoming lots have fraction nonconforming P=0.05, what is the probability of acceptance on the first sample? What is the probability of final acceptance? Calculate the probability of rejection on the first sample.

16. Consider a four component system of which the components are independent and identically distributed with CFR (Constant Failure Rate). If $R_s(100)$=0.95 is the specified reliability, find the individual component Mean Time To Failure.

17. Consider a system consisting of five components which are independent and identically distributed with Constant Failure Rate. If $R_s(50)$=0.92 is the specified reliability, find the individual component Mean Time To Failure.

18. Let a parallel system be composed of n=2 identical components, each with failure rate λ=0.01 and time t=10 hours, only one of which is needed for system success. Then find total system reliability and Mean Time To Failure.

19. A space vehicle requires three out of its four main engines to operate in order to achieve orbit. If engine has a reliability of 0.97, determine the reliability of achieving orbit.

20. A manufacturing process produces parts which are one percent defective. Fifty of these parts are selected at random. What is the probability that there are two or less defective parts out of the fifty selected parts?

SECTION-C

21. A manufacturer produces two types of models M_1 and M_2. Each M_1 model requires 4 hours of grinding and 2 hours of polishing; whereas each M_2 model requires 2 hours of grinding and 5 hours of polishing. The manufacturer has 2 grinders and 3 polishers. Each grinder works for 40 hours a week and each polisher works for 60 hours a week. Profit on an M_1 model is Rs.3.00 and on an M_2 model is Rs.4.00. Whatever is produced in a week is sold in the market. How should the manufacturer allocate his production capacity to the two types of models so that he may make the maximum profit in a week?

22. Solve graphically the following L.P.P:

$$\text{Maximize } z = 3x_1+2x_2$$

Subject to the constraints:

$$-2x_1+x_2 \leq 1$$
$$x_1 \leq 2$$
$$x_1+x_2 \leq 3$$
and $$x_1, x_2 \geq 0.$$

23. Find the minimum value of $z = 600x_1+400x_2$

Subject to the constraints:

$$1500x_1+1500x_2 \geq 20000$$
$$3000x_1+1000x_2 \geq 40000$$
$$2000x_1+5000x_2 \geq 44000$$
$$x_1, x_2 \geq 0.$$

24. Find the maximum value of $z = 3x_1+2x_2$

Subject to the constraints:

$$x_1-x_2 \leq 1$$
$$x_1+x_2 \geq 3$$
and $$x_1, x_2 \geq 0.$$

25. Use Simplex method to solve the following L.P.P

$$\text{Maximize } z = x_1-x_2+3x_3$$

Subject to the constraints:

$$x_1+x_2+x_3 \leq 10$$
$$2x_1-x_3 \leq 2$$
$$2x_1-2x_2+3x_3 \leq 0$$
$$x_1, x_2, x_3 \geq 0.$$

26. Use Simplex method to solve the following L.P.P

Minimize $z = x_1-3x_2+2x_3$

Subject to the constraints:

$$3x_1-x_2+3x_3 \leq 7$$
$$-2x_1+4x_2 \leq 12$$
$$-4x_1+3x_2+8x_3 \leq 10$$
$$x_1, x_2, x_3 \geq 0.$$

27. Use Big-M method to minimize $z = 2x_1+x_2$

Subject to the constraints:

$$3x_1+x_2=3$$
$$4x_1+3x_2 \geq 6$$
$$x_1+2x_2 \leq 4$$
$$x_1, x_2 \geq 0.$$

28. Use Two-Phase Simplex method to maximize $z = 5x_1-4x_2+3x_3$

Subject to the constraints:

$$2x_1+x_2-6x_3 = 20$$
$$6x_1+5x_2+10x_3 \leq 76$$
$$8x_1-3x_2+6x_3 \leq 50$$
$$x_1, x_2, x_3 \geq 0.$$

29. Write down the dual of the following L.P.P and solve it.

Maximize $z = 2x_1+x_2$.

Subject to the constraints:

$$x_1+2x_2 \leq 10$$
$$x_1+x_2 \leq 6$$
$$x_1-x_2 \leq 2$$
$$x_1-2x_2 \leq 1$$
and $x_1,x_2 \geq 0.$

30. Use Dual Simplex Method to solve the following L.P.P

Maximize $z = -3x_1-x_2$

Subject to the constraints:

$$x_1+x_2 \geq 1$$
$$2x_1+3x_2 \geq 2$$
And $x_1,x_2 \geq 0.$

SECTION-D

31. Determine an initial basic feasible solution to the following Transportation problem using the North-West corner method.

	D_1	D_2	D_3	D_4	D_5	D_6	**Availability**
O_1	9	12	9	8	4	3	**5**
O_2	7	3	6	8	9	4	**8**
O_3	4	5	6	8	10	14	**6**
O_4	7	3	5	7	10	9	**7**
O_5	2	3	8	10	2	4	**3**
Requirement	**3**	**4**	**5**	**7**	**6**	**4**	

32. Determine an initial basic feasible solution to the following Transportation problem using Matrix Minima Method.

Origin	Destinations				Supply
	D_1	D_2	D_3	D_4	
O_1	1	5	3	3	**34**
O_2	3	3	1	2	**15**
O_3	0	2	2	3	**12**
O_4	2	7	2	4	**19**
Demand	**21**	**25**	**17**	**17**	

33. Obtain an initial basic feasible solution to the following Transportation Problem using the Vogel's Approximation Method.

	Destination				
Origin	D_1	D_2	D_3	D_4	**Supply**
O_1	2	4	3	8	**20**
O_2	6	4	3	7	**40**
O_3	6	2	4	2	**40**
Demand	**10**	**70**	**10**	**10**	

34. Obtain an Optimum basic feasible solution to the following transportation problem.

Factory	Ware house				Factory capacity
	W_1	W_2	W_3	W_4	
F_1	19	30	50	10	**7**
F_2	70	30	40	60	**9**
F_3	40	80	70	20	**18**
Warehouse requirement	**5**	**8**	**7**	**14**	

35. Solve the following transportation problem.

Source	Destination			
	D_1	D_2	D_3	**Availability**
O_1	2	7	4	**5**
O_2	3	3	1	**8**
O_3	5	4	7	**7**
O_4	1	6	2	**14**
Requirement	**7**	**9**	**18**	**34**

36. A company has three plants at locations A, B and C, which supply to ware houses located at D, E, F, G and H. Monthly plant capacities and 800, 500 and 900 units respectively. Monthly warehouse requirements are 400, 400, 500, 400 and 800 units respectively. Unit transportation costs (In rupees) are given below:

		To				
		D	**E**	**F**	**G**	**H**
From	**A**	5	8	6	6	3
	B	4	7	7	6	5
	C	8	4	6	6	4

Determine an optimum distribution for the company in order to minimize the total transportation cost by MODI-Method.

37. Find the Optimum solution to the following transportation problem.

Source	**Destination**			
	D_1	**D_2**	**D_3**	**Supply**
O_1	4	8	8	**76**
O_2	16	24	16	**82**
O_3	8	16	24	**77**
Demand	**72**	**102**	**41**	

38. A departmental head has four subordinators, and four tasks to be performed. The subordinates differ in efficiency, and the tasks differ in their intrinsic difficulty. His estimate of the time each man would take to perform each task, is given in the matrix below.

Tasks	**Men**			
	E	**F**	**G**	**H**
A	18	26	17	11
B	13	28	14	26
C	38	19	18	15
D	19	26	24	10

How should the tasks be allocated one to a men. So as to minimize the total man – hours ?

39. Solve the following Assignment problem

Jobs	Machines		
	A	B	C
I	4	6	7
II	3	5	9
III	4	2	8
IV	3	2	1

40. To assign four jobs to four workers. The varying skills of the workers gave rise to varying cost for performing the jobs the below table summarizes the cost data of the assignments. The data indicate that workers 'A' can't work on job 3 and worker 'c' cannot work on job 4. Determine the optimum assignment.

Workers	Jobs			
	1	2	3	4
A	50	50	-	20
B	70	40	20	30
C	90	30	80	-
D	70	20	60	70

41. A machine operator processes five types of items on his machine each week, and must choose a sequence for them. The set-up cost per change depends on the item presently on the machine and the set-up to be made according to the following table:

From Item	To item				
	A	B	C	D	E
A	∞	4	7	3	4
B	4	∞	6	3	4
C	7	6	∞	7	5
D	3	3	7	∞	7
E	4	4	5	7	∞

If he processes each type of item once and only once each week, how should he sequence the items on his machine in order to minimize the total set-up cost?

42. Solve the following sequencing problem and give the optimum sequence of jobs, minimum total elapsed time and individual idle times of M_1, M_2 in the case (the order of machines is M_1, M_2).

Jobs	J_1	J_2	J_3	J_4	J_5	J_6
Machine M_1	1	3	8	5	6	3
Machine M_2	5	6	3	2	2	10

43. The following table gives the machines time in (hours) for 5 jobs to be processed on two different machines in the order M_1, M_2. Find the sequence of the jobs that minimizes the total elapsed time to complete the jobs also calculate the individuals idle timings of M_1, M_2.

Job	Machine M_1	Machine M_2
A	10	4
B	2	12
C	18	14
D	6	16
E	20	18

44. Determine an Optimal sequence of jobs that minimizes total elapsed time. Jobs are to be processed on three machines M_1M_2 and M_3. in the order $M_1M_2M_3$

Jobs	A	B	C	D	E	F	G
Machine M_1	3	8	7	4	9	8	7
Machine M_2	4	3	2	5	1	4	3
Machine M_3	6	7	5	11	5	6	12

45. Find the sequence that minimize the total time required in performing the following jobs on three machines in the order M_1M_2 and M_3.

Jobs	A	B	C	D	E	F
Machine M_1	8	3	7	2	5	1
Machine M_2	3	4	5	2	1	6
Machine M_3	8	7	6	9	10	9

SECTION-E

46. Construct mean, range and standard deviation charts for the following data using MS-EXCEL.

	Sample No's													
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
X_1	6	15	12	9	10	7	8	16	8	6	16	7	11	15
X_2	9	16	11	7	4	8	9	10	12	13	9	13	7	10
X_3	10	10	10	8	6	10	6	8	14	9	13	10	10	11
X_4	15	13	10	12	11	5	13	9	16	11	15	12	16	14

47. The following are the figure of defectives in 30 lots each containing 1500 items. Draw the control chart for fraction defective using MS-EXCEL.
128, 213, 72, 510, 115, 128, 67, 100, 28, 215, 300, 118, 66, 126, 193, 180, 351, 320, 206, 256, 244, 125, 300, 190, 68, 75, 72, 718, 196, 200.

48. The following data gives number of defectives in 10 independent samples of varying sizes from a production process.

Sample no.	1	2	3	4	5	6	7	8	9	10
Sample size	2000	1400	1300	1250	1150	1660	1775	1855	3025	1475
No. of defectives	325	330	116	241	125	222	180	206	237	205

Draw the control chart for fraction defective using MS-EXCEL.

49. The number of defects in 20 pieces of cloth each of 100 meters length is given below:
1,3,3,1,6,4,3,7,10,2,2,6,4,3,2,7,1,5,6,4.
Draw the appropriate control chart and say whether the process can be considered to be in control using MS-EXCEL.

50. Draw the OC curve for the single sampling plan n=100 and c=2 using MS-EXCEL.

51. Consider a four component system of which the components are independent and identically distributed with CFR (Constant Failure Rate). If $R_s(200)=0.99$ is the specified reliability, find the individual component Mean Time To Failure using MS-EXCEL.

52. Solve the following L.P.P by simplex method using TORA.

Maximize $z = x_1-x_2+3x_3$

Subject to the constraints:

$$x_1+x_2+x_3 \leq 10$$
$$2x_1-x_3 \leq 2$$
$$2x_1-2x_2+3x_3 \leq 0$$
$$x_1, x_2, x_3 \geq 0.$$

53. Solve the following L.P.P by Big-M method using TORA.

Maximize $z = 8x_2$

Subject to the constraints:

$$x_1-x_2 \geq 0$$
$$2x_1+3x_2 \leq -6$$
$$\text{and } x_1, x_2 \geq 0.$$

54. Solve the following L.P.P by Two-Phase Simplex method using TORA.

Minimize $z = (15/2)\, x_1 -3x_2$

Subject to the constraints:

$$3x_1-x_2-x_3 \geq 3$$
$$x_1-x_2+x_3 \geq 2$$
$$x_1, x_2, x_3 \geq 0.$$

55. Write down the dual of the following L.P.P using TORA.

Maximize $z = 4x_1+2x_2$

Subject to the constraints:

$$x_1+x_2 \geq 3$$
$$x_1-x_2 \geq 2$$
$$x_1,x_2 \geq 0.$$

56. Solve the following L.P.P by Dual Simplex Method using TORA.

Maximize $z = -2x_1-2x_2-4x_3$

Subject to the constraints:

$$2x_1+3x_2+5x_3 \geq 2$$
$$3x_1+x_2+7x_3 \leq 3$$
$$x_1+4x_2+6x_3 \leq 5$$
$$x_1,x_2,x_3 \geq 0.$$

57. Determine an initial basic feasible solution to the following Transportation Problem by North-West corner method using TORA.

		Warehouses			
		W_1	**W_2**	**W_3**	**Supply**
Plant	**P_1**	7	6	9	**20**
	P_2	5	7	3	**28**
	P_3	4	5	8	**17**
Demand		**21**	**25**	**19**	

58. Consider the following Transportation problem.

	Destination				
Source	**1**	**2**	**3**	**4**	**Availability**
1	20	22	17	4	**120**
2	24	37	9	7	**70**
3	32	37	20	15	**50**
Requirement	**60**	**40**	**30**	**110**	**240**

Determine an initial basic feasible solution by Matrix Minima Method using TORA.

59. Consider the following Transportation problem.

	Destination				
Origin	**D_1**	**D_2**	**D_3**	**D_4**	**Availability**
O_1	1	2	1	4	**30**
O_2	3	3	2	1	**50**
O_3	4	2	5	9	**20**
Requirement	**20**	**40**	**30**	**10**	**100**

Determine an initial basic feasible solution by Vogel's Approximation Method using TORA.

60. Solve the following Assignment problem using TORA.

		To				
		A	**B**	**C**	**D**	**E**
From	**1**	32	38	40	28	40
	2	40	24	28	21	36
	3	41	27	33	30	37
	4	22	38	41	36	36
	5	29	33	40	35	39