BLDE ASSOCIATION'S
S.B. ARTS AND K.C.P. SCIENCE COLLEGE,
VIJAYAPUR

DEPARTMENT OF STATISTICS

LAB MANUAL

2023-24

RANI CHANNAMMA UNIVERSITY, BELAGAVI

BSc I Sem Statistics Practicals

Note:

1. Solve any three out of 4 questions
2. 10 marks for each question with formula and necessary steps in solving
3. 5 marks Viva, 5 marks journal and 10 marks for internal assessment
4. Time duration for practical exam 3 hours

(Frequency Distribution-I)

Presentation of data by frequency table, diagrams and graphics, stem and leaf, partition values

A1. Following data relates us to the waiting time at A.T.M for various customers on a day

12 15 10 08 20 15 16 05 08 15 20 10 15 18 20 10 15 12 10 20 12 18 15
08 15 08 15 12 10 08 08 12 15 18 10 15 15 20 12 10 22 16 12 08 15

a) Construct Frequency table b) Construct Histogram

A2. CET marks of Jain College before admission as taken. 55 students appeared in CET. Their scores are recorded below out of maximum 75 marks.

32 36 47 52 60 73 38 45 62 73 68 52 61 51 32 58 47 52 60 73 38 40 62
73 63 52 61 53 68 55 61 51 32 38 60 36 58 70 63 48 61 51 68 55 61 51
38 66 32 36 47 52 38 45 62

a) Construct Frequency table with class width 8 each.
b) Construct less than and more than Ogive curves.

A3. 30 households in Dharwad city were survived payment made by this household are recorded into rupees as follows.

750	640	560	650	1170	818	720	865	900	832
1156	1050	529	685	678	1120	620	765	900	850
980	850	920	1075	700	775	1030	940	989	930

a) Construct Frequency distribution table with suitable class intervals
b) Compute cumulative frequency distribution
c) Construct frequency polygon

(Frequency Distribution-II)

A1. Standard test where administrated to determined I2 core, their scores are recorded in the following table.

120	155	118	132	135	125	122	140	137	127	128	130	116	119
132	127	133	126	120	125	130	134	135	127	116	115	125	130
142	140												

a) Construct Frequency table
b) Construct a Histogram
c) Construct Stem and Leaf

A2. Administration of K. M. C as ordered a study of amount of time a Patient must wait before being created by emergence room personally the following data collected during typical day.

12	16	21	20	24	3	11	17	29	18	23	4	7	4	25	27	15	26	1

a) Construct Frequency distribution with width 6
b) Construct Stem and Leaf

A3. Before admission of S.B Arts and K. C. P Science College the student have total basic test, fundamental of mathematics in one examination 40 students have appears and sure are given below.

15	12	15	22	28	13	19	25	24	28	10	15	16	20	16	22	18	20
17	14	12	19	21	21	18	19	13	30	10	21	15	20	22	18	20	12
23	19	22	24														

a) Construct frequency distribution table with suitable class interval
b) Construct Stem and Leaf display
c) Construct Ogive curve

Measures of Central Tendency-I

A1. Distribution of marks obtained by 110 candidates in statistics paper of KAS exam. Find the Arithmetic Mean (AM), Geometric Mean (GM) and Harmonic Mean (HM).

Marks	10-20	20-30	30-40	40-50	50-60	60-70
Students	5	11	22	35	23	14

A2. The daily wages of 100 works are given below. Calculate AM, GM and HM.

Daily Wages	100-199	200-299	300-399	400-499	500-599
No of Works	15	18	30	20	17

A3. The distribution of marks obtained by 100 students in an examination. Compute AM, GM and HM.

Marks	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80
No of Students	5	12	15	18	25	16	7	2

Measures of Central Tendency-II

A1. The frequency table represent the sell of milk packets at milk shop on various days . Compute mean, median and mode.

Sales	40-50	50-60	60-70	70-80	80-90	90-100	100-110
No of days	8	14	16	22	18	13	7

A2. Following are test marks obtained by students (maximum 65 marks). Compute mean, median and mode.

Marks	Above	Above	Above	Above	Above	Above	Above	Above
No of students	75	67	54	36	21	10	7	3

A3. Find the median, quartiles, 7^{th} deciles and 82^{nd} percentile for the following data.

Wages	0-10	10-20	20-30	30-40	40-50
No of students	22	38	46	35	20

Measures of Dispersion-I

A1. Compute range and coefficient of range for the following values.

100 24 14 105 21 35 106 16 104 72 68 103 61 90 20

A2. Calculate quartile deviation and its relative measure for the following frequency distribution.

Wages	Below 35	35-40	40-45	45-50	50-55	55-60	60-65	65 Above
No of Wrkers	12	18	22	26	36	23	19	8

A3. Calculate:

i. Mean deviation from mean

ii. Mean deviation from median

iii. Mean deviation from mode

And also calculate their Coefficients from the following data.

Marks	140-150	150-160	160-170	170-180	180-190	190-200
No of students	4	6	10	8	9	3

Measures of Dispersion-II

A1. The share policy of two companies given on 12 different days.

i. Which Company average share policy is more?

ii. Which Company is more consistent?

L.G	65	54	60	53	68	60	53	58	65	62	64	55
B.P.L	58	64	69	62	58	40	64	62	55	58	70	62

A2. The daily sale of two newspapers given on 12 different days in bookstall of Belagavi.

i. Which newspaper average sale is more?

ii. Which newspaper is more Consistent?

Vijayavani	85	54	60	73	68	60	63	58	65	82	64	65
Hosadigant	78	64	79	68	78	70	64	62	95	68	70	62

A3. Number of checks enhanced and each at 5 branches of S.B.M during last month had following frequency distribution. Director wants to know the standard deviation in check chasing.

CI	200-250	250-300	300-350	350-400	400-450	450-500
f	10	13	17	14	8	5

Measures of Skewness

A1. Calculate Karl Pearson's Coefficient of Skewness.

Scales	20-25	25-30	30-35	35-40	40-45	45-50	50-55
No of Days	8	13	17	14	10	7	3

A2. Calculate Bowley's Coefficient of Skewness.

CI	125-150	150-175	175-200	200-225	225-250	250-275	275-300
f	17	25	35	46	28	17	10

Correlation Coefficient

A1. Calculate the Karl Pearson's correlation for the following data taking 100 and 50 as the assumed averages of x and y respectively.

X	104	111	104	114	112	118	117	105	108	106	100	108	105
Y	57	55	47	45	50	64	63	64	63	66	62	69	61

A2. The index number of prizes of all commodities in Bombay and Kolkata were as undergo find the Karl Pearson's correlation coefficient.

No of commodity(Month)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
No of commodity prizes in Kolkata	169	182	182	192	198	209	227	238	250	253
No of commodity prizes in Bombay	104	222	225	228	229	233	249	266	256	255

A3. Find the spearman's rank correlation coefficient for the following data.

X	48	33	40	09	16	16	65	24	16	54
y	13	13	2	6	15	4	20	9	16	19

A4. 10 competitors in beauty context are ranked by 3 judges in the following order.

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

Random Variable

A1. From the following probability distribution k and then calculate

i. E(x) ii. V(x) iii. E (2x+5) iv. V (3x-5) v. V (-3/2x)

X	1	3	5	7	10
P(x)	k	4k	3k	k	2k

A2. From the following table find

i. E(x) ii. E(2x+4) iii. V(x) iv. V(3x-5)

X	-2	-1	0	1	2	3
P(x)	0.05	0.10	0.5	0.20	0.35	0.23

A3. A random variable x has following distribution

X	0	1	2	3	4	5	6
P(x)	a	3a	5a	7a	5a	3a	a

RANI CHANNAMMA UNIVERSITY, BELAGAVI

BSc II Sem Statistics Practicals

Note:

1. Solve any three out of 4 questions
2. 10 marks for each question with formula and necessary steps in solving
3. 5 marks Viva, 5 marks journal and 10 marks for internal assessment
4. Time duration for practical exam 3 hours

Probability Distribution

A1. Two dice are thrown, find the probability

i. Both dice shows same number
ii. Product of the number is perfect square
iii. The sum of the numbers is 7 or 10
iv. The sum of the numbers is divisible by 3
v. The sum of the numbers is 5 or 8

A2. A box contains 20 tickets numbered from 1 to 20 one ticket is drawn at random. Find the probability of that drawn ticket has a number

i. Multiple of 4
ii. Multiple of 3 or 7
iii. Multiple of 3 or 5

Binomial Distribution

A1. An unbiased coin is tossed 6 times. Find the probability of obtaining

i. Exactly 3 heads
ii. Less than 3 heads
iii. More than 3 heads
iv. At most 3 heads
v. At least 3 heads

A2. In a group there are 200 trees out of which 50 are mango tree. Among them if 20 sample of 3 trees each are selected. In how many samples will you expect.

i. Exactly 1 mango tree
ii. More than 1 mango tree
iii. Less than 1 mango tree

Fitting of Binomial Distribution

A1. Coins are tossed 128 times and following distribution is obtained

No of heads	0	1	2	3	4	5	6	7
No of tosses	7	7	21	30	26	20	14	3

Fit a Binomial Distribution.

A2. The following table shows how many packets were found to contain a defective, 1 defective, 2 defective, 3 defective, 4 defective to fit a Binomial Distribution

No of defective	0	1	2	3	4
No of packets	2	17	28	14	3

A3. A survey of 100 family each having 5 children revealed the following distribution

No of children	0	1	2	3	4	5
No of fsmilies	9	24	35	24	6	2

Fit a Binomial Distribution.

Poisson Distribution

A1. It is known that a number of heavy trucks arriving at a railway station follows the Poisson distribution, if the arrange number of truck arriving during a specific period of an hour is 2. Find the probabilities that during a given hour.

i. No heavy trucks arrived
ii. At least two trucks will arrive

A2. On an average a typist makes 3 mistakes while typing a page that is the probability that a randomly selected page is free of mistakes? among 500 pages in how pages would you expect mistakes.

A3. If the probability that an individual suffers a bad reaction from an injection of a given serum is 0.001. Determine the probability that out of 500 individuals

i. Individual exactly 3
ii. More than 2 individual suffer from bad reaction.

A4. It is know that 3% of a certain source manufactured by a firm is defective. What is the probability that defective screws found in a box of 100 screws.

Fitting of Poisson Distribution

A1. Fit a poisson distribution to the following data and hence find the theoretical frequency

X	0	1	2	3	4	5	6	7
f	132	58	34	12	9	3	2	0

A2. The following mistakes per page were observed in a book.

No of mistakes per page	0	1	2	3	4
No of pages	211	90	19	5	0

Fit a Poisson distribution to the data obtained expected frequencies.

Normal Distribution

A1. If x is a normal variate with mean 64 and variate 144. Find the probability that

i. $x \geq 64$
ii. $60 < x < 66$
iii. $x < 62$

A2. Heights of 2000 soldiers are normally distributed with mean 165cm and variate $16cm^2$. Find the numbers of soldiers with height.

i. Least than 170cm
ii. Between 160cm and 168cm
iii. More than 163cm

RANI CHANNAMMA UNIVERSITY, BELAGAVI

BSc III Sem Statistics Practicals

Note:

1. Solve any three out of 4 questions
2. 10 marks for each question with formula and necessary steps in solving
3. 5 marks Viva, 5 marks journal and 10 marks for internal assessment
4. Time duration for practical exam 3 hours

Bivariate Distribution-I

A1. The joint distribution of x and y is given by the following data

X/Y	1	3	9
2	1/8	1/24	1/12
4	1/4	1/4	0
6	1/8	1/3	1/2

i. Find the marginal distribution of x and y
ii. Find the conditional distribution of y/x = 6
iii. Find the conditional distribution of x/y = 9

A2. For the joint distribution of two random variable x and y is given below.

X/Y	1	2	3	4
1	4/36	3/36	2/36	1/36
2	1/36	3/36	3/36	2/36
3	5/36	1/36	1/36	1/36
4	1/36	2/36	2/36	5/36

i. Find the marginal distribution of x and y
ii. Conditional distribution of x/y = 1
iii. Conditional distribution of y/x = 2

A3. The joint probability density function of two random variable (x, y) is given by

$f(x, y) = 2 \quad 0<x<1, 0<y<x$

$= 0 \quad$ 0therwise

i. Find the marginal distribution of x and y
ii. Find the conditional density function of y/x : x
iii. Find the conditional density function of x/y : y
iv. Check whether for independent of x and y

A4. The joint distribution of x and y is given by

$f(x) = 4xye^{-(x2+y2)}$ $x \geq 0, y \geq 0.$

Test whether x and y are independent for the above joint distribution. Find the conditional density function of x/y: y and y/x: x

Bivariate Distribution-II

A1. Let x be a random variable with the following probability distribution.

X	-3	6	9
P(X: x)	1/6	1/2	1/3

Find the E(x) and $E(x^2)$ and also evaluate the $E(2x+1)^2$

A2. Joint probability function of x and y is given by

y/x	0	1	2	4
0	0	0.05	0.05	0.10
1	0.08	0.15	0.10	0.10
2	0.20	0.12	0.05	0

i. Compute E(x), E(y), V(x), V(y)

ii. Compute E(x+y), E(xy)

iii. Find the correlation coefficient between x and y

A3. Two random variables x and y have the following joint probability density function

$f(x) = 2-x-y \quad 0 \leq x \leq 1, \ 0 \leq y \leq 1$

$= 0 \quad$ otherwise

i. Marginal probability density function of x and y

ii. Conditional density function

iii. Compute V(x) and V(y)

iv. Find covariance between x and y

Chebychev's Inequality

A1. Find the least value of probability of $1 \leq x \leq 7$ or p $(1 \leq x \leq 7)$ where x is a random variable with $E(x) = 4$ and $V(x) = 4$

A2. In a random variable x has mean 50 and variance 100. Use Chebychev's inequality to obtained operational bonds for

i. $P[\ |x-50| \geq 15\ ]$

ii. $P[\ |x-50| < 20]$

A3. A symmetric die is thrown 600 times. Find the lower bond for the probability of getting 80 to 120 sixes.

Discrete Distribution

A1. If x is uniformed distribution with mean $\mu^1 1 = 1$ and its variances 4/3. Find $p(x < 0)$.

A2. If x follows binomial distribution then the mean and variance are 4 and 4/3 respectively. Find $p(x \geq 1)$.

A3. If x and y are the independent Poisson variates such that $p(x = 1) = p(x = 2)$ and $p(y = 2) = p(y = 3)$ then find the $V(x-2y)$.

Continuous Distribution

A1. Show that the exponential distribution lack's memory i.e, if x has an exponential distribution then for every constant $a \geq 0$ one has

$P(Y \leq x / x \geq a) = p(X \leq x)$ for all x, where $Y = X-a$.

A2. Let X ~N(0, 1) and Y~ N(0, 1) be independent random variable. Find the distribution of x/y and identify it.

A3. Let X have a (standard) Cauchy distribution. Find a p.d.f for x^2 and identify its distribution.

Generating Random Sample from Discrete Distribution

A1. Generate random samples from Binomial Distribution.

A2. Generate random samples from Poisson Distribution.

Generating Random Sample from Continuous Distribution

A1. Generate random samples from Uniform Distribution.

A2. Generate random samples from Normal Distribution.

A3. Generate random samples from Exponential Distribution.

RANI CHANNAMMA UNIVERSITY, BELAGAVI

BSc IV Sem Statistics Practicals

Note:

1. Solve any three out of 4 questions
2. 10 marks for each question with formula and necessary steps in solving
3. 5 marks Viva, 5 marks journal and 10 marks for internal assessment
4. Time duration for practical exam 3 hours

Mean Square Error of Estimation.

A1. A random sample of size 'n' is drawn from Poisson distribution with unknown parameter λ to estimate λ. Two estimators are purposed T1 = $1/n \sum xi$, T2 = $1/(n+1) \sum xi$. Obtain mean square error of the estimator of T1 and T2 assuming n = 4. Compare then for floating MSE on group and give your conclusion.

A2. Given a random sample size 3 drawn from the normal population with mean μ and variance 1. Find the MSE of following two estimators on graph and comment on the result.

T1 = $1/3 \sum xi$, T2 = $1/2 \sum xi$ assuming n = 5.

Maximum Likelihood Estimator-I

A1. Find the maximum likelihood estimator of a parameter of Poison distribution also compute the value of estimator if 4 successes are 2, 9, 4, 7 occurs.

A2. For the population with pdf $f(x: \theta) = 1/\theta\, e^{-x/\theta}$, $x>0$, $\theta>0$, the following sample observations are drawn 1.5, 6.5, 19.1, 12.8, 23.8, 30.2, 2.5, 5.8, 28.2, 13.4, 17.8, 6.9, 10.3, 16.8, 26.3, 7.4, 16.4, 13.4, 19.4, 29.8. Obtain MLE of θ.

A3. For the following data, regarding distribution of number of printing mistake for a page. Obtain average number of printing mistake by the method of MLE.

No of mistakes	0	1	2	3	4	5
No of pages	42	33	14	6	4	1

A4. A random sample f size 8 is drawn from the distribution with pdf $f(x: \theta) = (1+\theta)\, x^{\theta}$, $0<x<1$. Obtain MLE of θ based on the following sample observation 0.2, 0.4, 0.5, 0.8, 0.7, 0.9, 0.75, 0.95.

Maximum Likelihood Estimator-II

A1. Let X1, X2,.....,Xn be a random sample of size 'n' drawn from the uniform distribution with pdf $f(x: \theta) = 1/\theta$, $0 \le x \le \theta$, $\theta>0$. Obtain MLE of θ, if the sample observations are 2, 8, 10, 15, 6, 8

A2. Obtain MLE of α and β for rectangular population with pdf $f(x: \alpha, \beta) = 1/\beta-\alpha$, $\alpha <x< \beta$ if sample values are 5, 15, 6, 3, 20.

A3. Obtain MLE of α and β from a random sample drawn from the population with pdf $f(x: \alpha, \beta) = Y e^{-\beta(x-\alpha)}$ $\alpha<x\le0$, $\beta>0$ and Y0 is constant.

A4. Let X1, X2,.....,Xn denote a random sample drawn from a uniform distribution with pdf $f(x: \theta) = 1$ if $\theta-1/2\le x\le \theta+1/2$, $-\infty\le\theta\le\infty$. Obtain MLE for θ.

A5. Members of large population belongs to 4 categories is proportional to $1-\theta/2$, $1+\theta/4$, $1-\theta/4$, $\theta/2$, a random sample of 120 observations in 4 categories are respectively 40, 25, 35, 20 obtain MLE for θ.

A6. The following table gives the probability and frequency in 4 classes AB, Ab, aB, ab. Estimate the parameter θ by MLE method.

Class	AB	Ab	aB	ab
Frequency	108	27	30	8
Probability(Pi)	$(2+\theta)/4$	$(1-\theta)/4$	$(1-\theta)/4$	θ

Interval Estimation

A1. A sample of size 900 has been with mean 3.4 cm and standard deviation 2.61 cm if the population is normal and its mean is unknown. Find 95% and 99% confidence limits of the population mean.

A2. A random sample of 200 villages taken from 'A' district with mean population per village was to be 485 with standard deviation 50. Another random sample of 200 villages is taken from

the 'B' district with mean population per village was to be 500 with standard deviation 40. Compute 95% and 99% confidence limits and write confidence interval for mean.

A3. A sample of 100 voters was chosen at random from all voters in a district indicated that 55% of them were in fever of a particular candidate, Find 95% and 99% confidence limits for proportion of is fever also write confidence interval for same.

A4. In a random sample of 80 persons from town 'A' 30 are found to be consumer of wheat. In a random sample of 40 persons from town 'B' is are found to be consumers of wheat find 95% and 99% confidence limits and write confidence interval for same.

Testing of Hypothesis-I

A1. Let P be the probability that a coin fall in a head in a single toss to test H0:P=1/2 against H1:P=3/4 the coin is tossed 5 times and H0 is rejected if more than 3 head are obtained. Find the probability of type-I error, type-II error and power of test.

A2. A single observation is drawn from a Poisson distribution to test H0:λ=1 against H1:λ=2, reject H0 id observation value $x \geq 2$ find the value of α, β, 1-β.

A3. Given that probability function $f(X:a) = 1/\theta$, $0 \leq x \leq \theta$

$= 0$ otherwise

You are testing null hypothesis H0:θ=1 against H1:θ=2. Obtain size of type-I error, type-II error and power of test. If we choose the interval

i. $0.5 \leq x$

ii. $1 \leq x \leq 1.5$

A4. Map the power function by plotting at least 7 points on if for testing H0: μ=10 against H1:$\mu \neq 10$ using 2 ½ % table value of the $\bar{x}$ distribution with standard deviation 5 and a sample of size 16 is taken.

A5. In order to test H0: μ =85 against H1: $\mu \neq 85$ for normal distribution with variance 36 and a sample of size 10 was observed the critical region is to be taken outside the interval (8, 4.85) Graph the power function by plotting at least 7 points.

Testing of Hypothesis-II

A1. A random sample of size 'n' drawn from Poisson distribution with parameter 'λ' give most powerful (MP) test of size 'α' for testing H0:λ= λ0 against H1: λ= λ1> λ0.

A2. If random sample of size 'n' is drawn from Binomial distribution with parameter p. Construct MP (BCR) test of size α for testing H0:P=P0 against H1:P=P1>P0

A3. Obtain MP test for testing H0:θ=θ0 against H1:θ=θ1> θ0 based on random sample of size n drawn from the population with pdf $f(x: \theta) = (1+\theta)x^{\theta}$.

A4. Obtain MP test for testing H0: μ= μ0 against H1: μ= μ1 based on a random sample of size n drawn from normal population the σ^2 is known.

Large Sample Test

A1. A random variable of 900 items is fouynd the mean of 65.3 can it be regarded as from large with mean 66.2 and standard deviation 5(use percentage level of significance)

A2. Two samples were drawn from two normal population with mean μ1 and μ2 the following information is available on these samples regarding expenditure in rupees per month per family.

	Size	Mean	Variance
Type-I	42	744.85	158165.43
Type-II	32	516.78	26413.61

Test whether average expenditure per month per family is equal.

A3. A sample 3000 persons were selected at random from a city. In this sample their were 1632 males does these information support the view that the number of males and females are equal in city? Test that 1% level of significance.

A4. In a certain district A, 450 persons were considered as regular customer of tea out of a sample of 1000 persons. In another district B 400 persons were regular customer of tea out of sample of 800 persons does this fact reveal a significant between the two district as the for tea drinking habit as censured.

Small Sample Test

A1. A manufacturer claims that a special type of projector bulb has an average life 160 hours. To check this claim an investigator takes a sample of 20 such bulbs, pots on the test, and obtain on average life 167 hours with standard deviation 16 hours that the life tile of such bulbs follows normal distribution does the investigator accept the manufacturers claim at 5% level of significance.

A2. In a random sample of 10 pigs fed by diet A. The gain in weights (in pound) in a certain period were 12, 8, 14, 16, 13, 12, 8, 14, 10, 9

In other random sample of 10 pigs fed by diet B, the gain weights (in pound) in the same period were 14, 13, 12, 15, 16, 14, 18, 17, 21, 15.

Assuming that gain in the weighs due to both food follows normal distributions with equal variances, test whether diets A and B differ significantly regarding their effect on increase in weight at 5% level of significance.

RANI CHANNAMMA UNIVERSITY, BELAGAVI

BSc V Sem P-I Statistics Practicals

Note:

1. Solve any three out of 4 questions
2. 10 marks for each question with formula and necessary steps in solving
3. 5 marks Viva, 5 marks journal and 10 marks for internal assessment
4. Time duration for practical exam 3 hours

Calculation of Determinant of Higher Order

A1. Find the determinant of the following matrices using transformation

i. $A = \begin{matrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{matrix}$

ii. $B = \begin{matrix} 1 & -1 & 3 \\ 1 & 3 & -3 \\ 1 & 3 & 3 \end{matrix}$

iii. $A = \begin{matrix} 1 & 2 & -2 & 3 \\ 2 & 5 & 4 & 7 \\ -1 & -3 & 2 & -1 \\ 2 & 4 & -1 & 3 \end{matrix}$

iv. $B = \begin{matrix} 6 & 1 & 3 & 8 \\ 4 & 2 & 6 & -1 \\ 10 & 3 & 9 & 7 \\ 16 & 4 & 12 & 15 \end{matrix}$

Calculation of Rank of Matrix

A1. Find the rank of following matrix by direct method

i. $A = \begin{matrix} 1 & 2 & 3 & 4 \\ 2 & 4 & 6 & 8 \\ 3 & 6 & 9 & 12 \end{matrix}$

ii. $B = \begin{matrix} 2 & 1 & -1 \\ 0 & 3 & -2 \\ 2 & 4 & -3 \end{matrix}$

Calculation of Equivalent Canonical form by using Row and Column Operations

A1. Reduce the following matrices to the canonical form by using row and column operations

i. $A = \begin{matrix} 1 & -1 & 1 \\ 2 & -3 & 4 \\ 3 & -2 & 3 \end{matrix}$

ii. $B = \begin{matrix} 1 & 0 & 2 & -2 \\ 2 & -1 & 0 & -1 \\ 1 & 0 & 2 & -1 \\ 4 & -1 & 3 & -1 \end{matrix}$

Calculation of Symmetric Matrices of Higher Order by Partitioning Method

A1. Let consider the matrix A is a symmetric matrix of order nxn i.e.

$A = \begin{matrix} P & Q \\ R & S \end{matrix}$ where $|p| \neq 0$

Then A^{-1} is given as $A^{-1} = \begin{matrix} X & Y \\ Z & W \end{matrix}$

to determine the values of X, Y, Z and W. Following steps are to be follow

i. P^{-1} ii. $T=RP^{-1}$ iii. $W=[S-TQ]^{-1}$ iv. $Z=-WT$ v. $Y=-P^{-1}QW$

vi. $X= P^{-1}-YT$

A2. Find A^{-1} by using portioning method.

i. $A = \begin{matrix} 1 & 1 & -1 \\ 1 & 2 & 0 \\ -1 & 0 & 5 \end{matrix}$

ii. $A = \begin{matrix} 1 & 2 & 3 & 4 \\ 2 & 5 & 6 & 7 \\ 3 & 6 & 8 & 9 \\ 4 & 7 & 9 & 10 \end{matrix}$

Calculation of Inverse Matrices of Higher Order

A1. Find the inverse of matrix by using adjoint method

$$A = \begin{matrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 2 & 9 \end{matrix}$$

A2. Find the inverse of following matrices by using elementary row and column operations

$$A = \begin{matrix} 1 & 2 & 3 \\ 5 & 1 & 2 \\ 4 & 5 & 4 \end{matrix}$$

A3. Find the inverse of a matrix by using adjoint method

$$A = \begin{matrix} 1 & 2 & 3 \\ 1 & 3 & 4 \\ 1 & 4 & 3 \end{matrix}$$

Calculation of Eigen values and Eigen vector

A1. Find the eigen values and eigen vectors of the following matrices and also obtain the result in using in R- programming.

i. $A = \begin{matrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{matrix}$

ii. $B = \begin{matrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{matrix}$

SIMPLE LINEAR REGRESSION

A1. A data in the below table reports the aggregate consumption of y (billions of us dollars) and disposable income x (billions of us dollars) for a developing economy for the 12 years from 1888 to 1999

i	1	2	3	4	5	6	7	8	9	10	11	12
Y	102	106	108	110	122	124	128	130	142	148	150	154
x	114	118	126	130	136	140	248	156	160	164	170	178

i. Make a scatter plot of the data.

ii. Stating the assumption fit a simple linear regression model of the data.

iii. Interpreter Regression Coefficient.

iv. Obtain the estimated y values($\hat{y}$)

v. At the field line to the scatter plot.

vi. Find the estimate errors (E)

vii. Calculate the OLS estimate of σ^2.

RANI CHANNAMMA UNIVERSITY, BELAGAVI

BSc V Sem P-II Statistics Practicals

Note:

1. Solve any three out of 4 questions
2. 10 marks for each question with formula and necessary steps in solving
3. 5 marks Viva, 5 marks journal and 10 marks for internal assessment
4. Time duration for practical exam 3 hours

ANOVA One Way Classification

A1. Three process A, B, C are tested to see whether their outputs are equivalent. The following observations of output are made.

A : 10, 12, 13, 11, 10, 14, 15, 13
B : 9, 11, 10, 12, 13
C : 11, 10, 15, 14, 12, 13
Carry out the analysis of variance and state your conclusion.

A2. The test was given to 5 students taken at random from 5^{th} class of 3 schools of a town. The individual scores are
School 1 : 9, 7, 6, 5, 8
School 2 : 7, 4, 5, 4, 5
School 3 : 6, 5, 6, 7, 6
Carry out the analysis of variance and state your conclusion.

A3. Below are given the yields in grams per plots for the 3 varieties of cotton seed.
Variety 1 : 77, 70, 63, 84, 95, 81, 88, 101
Variety 2: 109, 106, 137, 79, 134, 78, 126, 98
Variety 3 : 46, 70, 71, 65, 61, 40, 47, 73
Carry out the analysis

ANOVA Two Way Classification

A1. Three varieties of coal were analysed by four chemist and ash content in the varieties was found to be are order.

Varieties	Chemists			
	1	2	3	4
A	8	5	5	7
B	7	6	4	4
C	3	6	5	4

Analyze the data and state your conclusion.

A2. The determination of visual acuity of three different distances was the subject of an experiment. Four subjects are chosen at random from a large group were used for their purpose is as follows.

Subjects	Distances		
	A	B	C
1	12	16	30
2	5	10	18
3	7	28	35
4	10	26	51

Analyze the data and state your conclusion.

Completely Randomized Design (C. R. D)

A1. The following table shows some of the results of an experiment on the effect of applications of the Sulphur in reducing the scale disease of potatoes. The object in applying Sulphur is to increase the acidity of the soil, since scale does not thrive in every acid soil. In addition to untreated plots which serve control. Three amounts of dressing are compared 300, 600 and 1200 pounds per acre. Both spring and fall application of each treatment was tested, so that in all there were 7 distinct treatments. The quality to be analyzed is the scale index, field plant and scale indices for CRD are given below.

F3	O	S6	F12	S6	S12	S3	F6
9	12	18	10	24	7	30	16
O	S3	F12	F6	S3	O	O	S6
10	7	4	10	21	24	29	12
F3	S12	F6	O	F6	S12	F3	F12
9	7	18	30	18	16	16	4
S3	O	S12	S6	O	F12	O	F3
9	18	17	19	32	5	26	4

Analyze the experiment and give your conclusion.

A2. Three treatment A, B, C are compared in a completely randomized design with four applications each. Analyze the yield and state your conclusion.

A	B	A	C	B	C	C	B	A	C	B	A
81	75	49	28	59	55	48	57	65	48	36	79

Randomized Block Design (R. B. D)

A1. Following the layout and yield in kg's of 4 varieties of wheat of 4 blocks. Perform an analysis of variance of this data and interpret the results.

I

A	C	D	B
5	13	7	11

II

B	A	D	C
12	6	8	13

III

D	C	A	B
7	15	6	12

IV

C	A	B	D
14	8	18	19

Obtain relative efficiency of RBD as compared with CRD.

A2. Estimate the missing observations in the following RBD and carryout the analysis

I

C	A	B	D
22	18	27	12

II

D	C	A	B
27	18	16	22

III

B	A	D	C
18	-	17	11

IV

A	C	D	B
15	23	17	10

Latin Square Design (L. S. D)

A1. A variety trail was conducted on wheat with four varieties in a given latin square design. Analuse the data interpret the result for the following plan of the experiment and the per plot yield is given.

C 15	B 23	A 20	D 20
A 19	D 19	C 21	B 18
B 19	A 14	D 17	C 20
D 17	C 20	B 21	A 15

Obtain efficiency of LSD relative to CRD and efficiency relative to RBD.

A2. Estimate the missing observation in the following LSD and carryout the analysis.

C 21	B 17	A 25	D 18
A 16	D 29	C 20	B 18
B 28	A 24	D -	C 30
D 22	C 19	B 20	A 18

Latin Square Design (L. S. D)

A1. A variety trail was conducted on wheat with four varieties in a given latin square design. Analuse the data interpret the result for the following plan of the experiment and the per plot yield is given.

C 15	B 23	A 20	D 20
A 19	D 19	C 21	B 18
B 19	A 14	D 17	C 20
D 17	C 20	B 21	A 15

Obtain efficiency of LSD relative to CRD and efficiency relative to RBD.

A2. Estimate the missing observation in the following LSD and carryout the analysis.

C 21	B 17	A 25	D 18
A 16	D 29	C 20	B 18
B 28	A 24	D -	C 30
D 22	C 19	B 20	A 18

RANI CHANNAMMA UNIVERSITY, BELAGAVI

BSc VI Sem P-I Statistics Practicals

Note:

1. Solve any three out of 4 questions
2. 10 marks for each question with formula and necessary steps in solving
3. 5 marks Viva, 5 marks journal and 10 marks for internal assessment
4. Time duration for practical exam 3 hours

Uniformly Most Powerful Test-I

A1. UMP test based on sample from Bernoulli and Poisson Distribution.

i. $X \sim B(p, q)$ show that the family follows MLR.

ii. Let X1, X2.....,Xn be a iid from Poisson distribution with parameter λ for testing $H0 : \lambda \leq \lambda 0$ against $H1 : \lambda > \lambda 0$. Test the UMP test.

Uniformly Most Powerful Test-II

A1. UMP test based on sample from Normal and Exponential distribution.

i. If X1, X2..... Xn be a random sample of size n from the pdf $P(x, \theta) = 1/\theta\, e^{-x/\theta}$ $x>0$, $\theta>0$ show that the pdf follows MLR property.

ii. Let X1, X2.....Xn be a random sample from $f(x, \theta) = 1/\theta\, e^{-x/\theta}$. Find the UMP size α-test for testing hypothesis $H0 : \theta \leq 1$ against $H1 : \theta > 1$

iii. Let X1, X2.....Xn be a random sample from Normal distribution with mean μ and variance 1 for testing the hypothesis $H0 : \mu \leq \mu 0$ against $H1 : \mu > \mu 0$. Find the UMP test at α-test.

Sequential Probability Ratio Test-I

A1. Construction of SPRT for Bernoulli and Normal Distribution.

i. Let X have a distribution $f(x, \theta) = \theta^x (1-\theta)^{1-x}$ $x=0, 1$ $0< \theta<1$ for testing $H0:\theta=\theta0$ against $H1:\theta=\theta1$ Construct SPRT.

ii. Give the SPRT for testing $H0:\theta=\theta0$ against $H1:\theta=\theta1$ $(>\theta0)$ in sampling from a normal density function $f(xi,\theta) = 1/\sigma \sqrt{2\pi} \exp(-1/2 (x-\theta)/\sigma)$ where σ is known

A2. Construction of SPRT for Binomial Distribution.

Sequential Probability Ratio Test-II

A1.

i. Evaluate SPRT for Bernoulli and Normal Distribution using OC and ASN function.

ii. Construct SPRT for Poisson distribution and also find its OC and ASN function.

Decision Theory

A1. The wholesaler of sports goods has an opportunity to buy 500 pairs of skill that have been declared no surplus by the government. The wholesaler will pay Rs 50% per pair and can obtain Rs 100% a pair by selling skill to retailers. The price is well established but the wholesaler has doubt as to just have many pair he will be able to sell any skill left over can be sell to discount outlets of Rs 20% a pair after careful consideration of historical data the wholesaler assign to probabilities to the demand as follows.

Retailer Demand :	1000 pairs	3000 Pairs	5000 Pairs
Probability :	0.6	0.3	0.1

Compute the Expected Value of Perfect Information(EVPI).

A2. The parker flower stop promises its customers delivery within four hour on all flower orders all flower are purchased on the pair day and delivered to parker by 8:00 the next morning parians daily demand roses is as follows.

Dozens of roses :	7	8	9	10
Probability :	0.1	0.2	0.4	0.3

Parker purchases roses for 10% per dozen and sales then for 30%. All unsold roses are donated to a local hospital. How many dozens of roses should parker order each evening to minimize its profits? What is the optimum expected profit?

A3. A person has two independent investments A and B available to him but he can undertake only are at a time due to certain constraints. He can choose a first and then stop or if A is successful then take B or vice-versa, the probability of success of A is 0.6 while for B it is 0.4. Both investments required an initial capital duty of Rs 10000% and both return nothing if the venture in unsuccessful, successful, completion of B will return Rs 24000%. Draw decision free and determine the best strategy Investigate the optimal course of action by decision criteria under certainty.

RANI CHENNAMMA UNIVERSITY, BELAGAVI

STATISTICS PRACTICALS (BSc VISEM, P-II)

Exp 1: SIMPLE RANDOM SAMPLING – I

1. Consider a population consists of 6 units with values 1,2,3,4,5 and 6. Write down all possible samples of size 2 by without replacement.
   Verify that
   (i) Sample mean is unbiased estimator of population mean
   (ii) Sampling variance is same as $V(\bar{y})_{WOR}$

2. A population consists of 4 units with values 4, 10, 6 and 5. Draw all possible simple random sample of size 2 by without replacement. Verify that
   (i) Sample mean is unbiased estimator of population mean.
   (ii) Sampling variance is same as $V(\bar{y})_{WOR}$

3. In a population of size N=5, the values of Y_i are 2, 4, 6, 8, 10. Write all possible sample of size n =3 without replacement.
   (a) Show that sample mean is unbiased estimate of population mean
   (b) Show that Var $(\bar{y}_n)_{WOR} \leq$ Var $(\bar{y}_n)_{WR}$

4. Below are given weights of five students 56, 49, 66, 64, 55. Enumerate all possible samples of size 2 without replacement.
   Show that
   (a) Sample mean is unbiased estimate of population mean
   (b) Sample mean square is unbiased estimate of population mean square.
   Also obtain variance of sample mean.

Exp 2: SIMPLE RANDOM SAMPLING – II

1. A random sample 10 has been taken from the population of 100 students without replacement whose heights are given below
   165, 160, 165, 170, 172, 160, 165, 175, 164, 168
   Estimate the mean height of the population and variance of estimate of mean.

2. A SRSWOR of 30 households was drawn from a city consisting 14848 households. The number of persons per household in the sample were as follow:
   5, 6, 3, 3, 2, 3, 3, 3, 4, 4, 3, 2, 7, 4, 3, 5, 4, 4, 3, 3, 1, 2, 4, 3, 4
   Estimate average number of person per family. Also find the variance of estimate.

3. In a certain bank there are 10000 deposit accounts. A SRS of 40 accounts was drawn without replacement. If Y denote the amount (in 1000 Rs) in a deposit account, the following data were obtained from sample $\sum y$ =900 & $\sum y^2$ = 25335. Obtain the estimate of average amount in a deposit & total deposit. Also estimate its variance.

Exp 3: STRATIFIED RANDOM SAMPLING – I

1. A population of size 800 is divided into three strata. Their sizes and S.D are given below

Stratum Number	Stratum Size (Ni)	Stratum S.D
1	200	6
2	300	8
3	300	12

A sample of size 120 is to be drawn from the population. Determine the sizes of the samples from three strata by
(i) Proportional allocation
(ii) Neymann allocation methods and compare the precisions of these methods.

2. A random sample of 50 units gives the following estimated stratum means and variance.

Stratum No	Ni	ni	$\bar{y}_i$	S_i^2
1	30	8	35	40
2	50	12	40	55
3	60	15	45	80
4	60	15	55	140

Estimate the population mean and population total and estimate their variances.

3. In a survey on the area under a crop a total of 186 villages in a district was divided into strata according to the area of the villages. From each stratum a sample under proportional allocation in the selected villages noted as follows.

Stratum no.	Strata Ni	Sample size ni	Area under the crop in the sample villages
1	72	8	15, 13, 9, 12, 13, 10, 14, 16
2	53	5	25, 20, 21, 22, 29
3	35	4	36, 45, 50, 51
4	26	3	91, 103, 81

(i) Obtain an estimate of the total area under the crop in the district.
(ii) Give the estimate of the variance of the estimate.

Exp 4: STRATIFIED RANDOM SAMPLING – II

1. A sample of 30 students is to be drawn from a population consisting of 300 students belong to two villages A & B. The mean and standard deviation of the marks are given below.

	Total number of students	Mean	SD
College A	200	30	10
College B	100	60	40

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

2. 500 farms are stratified according to size (acres) as follow.

Strata	Stratum Size	Stratum Mean Square	Stratum Mean
Large	80	144	50
Medium	160	64	30
Small	260	16	10

(a) Select sample of size 100 by proportional allocation
(b) Select sample of size 100 by optimum allocation

3. A sample of 50 students is to be drawn from a population consisting of 500 students belonging to three colleges A, B & C. The mean and mean square deviations of their marks are given below

Stratum No.	No.of Students	Mean	Mean square
A	250	30	10
B	100	60	40
C	150	40	30

How would you draw the sample using proportional allocation and optimum allocation technique? Hence find the estimate of population mean. Also obtain the gain in efficiency due to stratified random sampling under proportional allocation over simple random sampling without replacement.

4. A sample survey is to be undertaken to ascertain the mean annual income of firms in certain areas. The firms are stratified according to their principle products. A survey gave the following information.

Types of firms	No.of firms (Ni)	Mean income ($\bar{Y}_{Ni}$)	Standard Deviation ($\sigma_i 2$)
Sheep	161	10946	2236
Wheat	195	6402	2614
Dairying	274	2228	606
Others	382	1458	230

For a sample of 12 firms compute the sample size in each stratum under

(a) Proportional allocation
(b) Optimum allocation

Compare the precision of this methods with SRS.

Econometrics I

A1. Estimate the method curve $Y = \alpha+\beta x+\mu$ by the method of least squares from the following data.

Price (Y): 05, 06, 07, 08, 09, 11

Sales (x): 12, 17, 19, 24, 30, 29

A2. The following data were collected from five different plants in a certain industry

Total Cost (Y): 80, 44, 51, 70, 61

Production (x): 12, 14, 16, 11, 18

Find the value of α and β of the model $Y = \alpha+\beta x+\mu$. Estimate the total cost for a level of Production of 10 units.

Econometrics II

A1. Following data gives weekly expenditure of a family (Y) and the weekly income of a family (x)

X: 80, 100, 120, 140, 160, 180, 200, 220, 240, 260

Y: 70, 65, 90, 95, 110, 115, 120, 140, 155, 150

Estimate the model $Y = \alpha+\beta x+\mu$ by the ordinary least square method. Also estimate Y when X= 300.

A2. Using the following data estimate α and β in the model $Y = \alpha+\beta x+\mu$ by the method of Ordinary least squares. Estimate the investment when the change of output is 25.

Investment(Y): 65, 57, 57, 54, 66

Change in output(x): 26, 13, 16, 17, 27