

STA 401

Reg. No.

CREDIT BASED IV SEMESTER B.Sc. DEGREE EXAMINATION APRIL 2012

STATISTICS THEORY
STATISTICAL INFERENCE

Time: 3 Hrs

Max. Marks: 80

PART – A

Answer any TEN of the following:

2X10=10

1. a) If T is unbiased for θ , show that \sqrt{T} is biased for $\sqrt{\theta}$.
- b) Distinguish between an estimator and an estimate with an example.
- c) Define sufficiency of an estimator.
- d) If X_1, X_2, \dots, X_n is a random sample $U(0, \theta)$ find the moment estimator of θ .
- e) What is meant by interval estimation?
- f) Define simple and composite hypothesis.
- g) What do you mean by the size and power of a test?
- h) State any two properties of likelihood ratio test procedure.
- i) Mention any two situations where we use chi-square test.
- j) Write the standard errors of
 - (i) sample proportion
 - (ii) difference in means.
- k) What do you mean by Fisher's Z-transformation?
- l) What is meant by strength of SPRT?

PART – B

Answer any Two of the following:

2x10=20

2. a) Prove that sample mean \bar{x} is consistent for θ in $N(\theta, \frac{\theta}{n})$. (5)
- b) Let x_1, x_2 be independent random sample from $P(\lambda)$, show that $x_1 + x_2$ is sufficient for λ . (5)
3. a) Let x_1, x_2, \dots, x_n be a random sample from $f(x) = \frac{\theta^\alpha}{\Gamma(\alpha)} x^{\alpha-1} e^{-\theta x}, x > 0$ and α is known. Find the m.l.e. of θ . (5)

- b) Find the moment estimators of θ_1 and θ_2 for the uniform distribution $U(\theta_1, \theta_2)$. (5)
4. a) Derive the $100(1-\alpha)\%$ confidence interval for difference in means of two independent normal populations with unknown but common variance. (5)
- b) Derive $100(1-\alpha)\%$ confidence interval for the ratio of the variances of two independent normal populations. (5)

Answer any TWO of the following:

2x10=20

5. a) Explain (i) Type I error and Type II error (ii) One sided and two sided tests. (4)
- b) Find a Most Powerful Test for testing $H_0: f(x) = \frac{1}{\sqrt{2\pi}} e^{-x^2/2}$ against $H_1: \frac{1}{2} e^{-|x|}$ based on a sample of size one. (6)
6. a) Derive LRTP for testing $H_0: \mu = \mu_0$ against $H_1: \mu \neq \mu_0$ based on a sample of size n from a normal population with mean μ and unknown variance. (7)
- b) Explain the test procedure for testing the significance of population correlation coefficient. (3)
7. Derive LRTP for testing equality of variances of two independent normal populations whose means are unknown. (10)

Answer any TWO of the following:

2x10=20

8. a) Explain the test procedure for testing the equality of proportions. (5)
- b) Write a note on Yate's correction for continuity. (5)
9. a) Describe the χ^2 test of goodness of fit by stating the necessary assumptions. (5)
- b) Derive the Brandt Snedecor formula for χ^2 test statistic for testing independence of attributes in a $2 \times k$ contingency table. (5)
10. a) Describe Sequential Probability Ratio Test procedure. (4)
- b) Derive SPRTP for testing $H_0: \sigma = \sigma_0$ against $H_1: \sigma = \sigma_1 (> \sigma_0)$ in sampling from $N(\mu, \sigma^2)$. (6)

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CREDIT BASED IV SEMESTER B.Sc. DEGREE EXAMINATION APRIL 2013

STATISTICS THEORY
STATISTICAL INFERENCE

Time: 3 Hrs

Max. Marks: 80

PART – A

Answer any TEN of the following:

2X10=20

1. a) Define a null hypothesis and alternative hypothesis.
- b) What are Type I and Type II errors w.r.t. testing of hypothesis?
- c) Define Neymann Pearson fundamental lemma.
- d) Give any two instances where t-test is applicable.
- e) Define standard error of a statistic. What is the standard error of difference of proportions?
- f) What do you mean by Fisher's Z transformation?
- g) What is P-Value? How do you use in Test of Hypothesis?
- h) Define unbiased Test and consistent test.
- i) Write down the expression for constants of SP RTP.
- j) Write a note on applicability of nonparametric test.
- k) What a large sample approximation to median test?
- l) What is Wilcoxon signed rank test?

PART – B

Answer any Two of the following:

2x10=20

2. a) Define the following terms with examples
i) Sample space ii) Critical Region (5)
- b) A single observation is drawn from $U(0, \theta)$ distribution. It is desired to test $H_0: \theta = \theta_0$ against $H_1: \theta = \theta_1 (> \theta_0)$ based on the critical region $X \geq k$. Find the size and power function. (5)
3. a) Derive a Most Powerful Test of size α for testing $H_0: \lambda = \lambda_0$ against $H_1: \lambda = \lambda_1 (> \lambda_0)$ in Poisson with parameter λ . (5)

b) Show that MP tests obtained using Neymann Pearson lemma are unbiased. (5)

4. Derive LRTP for testing equality of means of two independent Normal populations whose variances are unknown. State the test procedure for one sided tests. (10)

Answer any TWO of the following: **2x10=20**

5. a) Explain the test for correlation coefficient in a bivariate Normal population and also give the test procedure for large sample.

b) P_1 and P_2 are the proportions of individuals possessing a specified characteristic in two independent populations. Derive the large sample test for testing $H_0: P_1 = P$ against $H_1: P_1 \neq P$. State the critical regions for

i) $P_1 > P$ ii) $P_1 < P$ (4+6)

6. a) Stating the assumptions clearly describe chi-square test of goodness of fit. Identify the degrees of freedom.

b) Derive Brandt-Snedecor formula for chi-square test statistic for testing the independence of attributes in a 2xk contingency table. (4+6)

7. a) Write down a note on Yate's correction for continuity.

b) Obtain the large sample test for testing $H_0: \rho_1 = \rho_2$. Where ρ_1 and ρ_2 are the correlation coefficients between the variates in two independent bivariate Normal populations. (4+6)

Answer any TWO of the following: **2x10=20**

8. a) Derive SPRTP of strength $(1-\beta)$ for testing $H_0: \sigma = \sigma_0$ against $H_1: \sigma = \sigma_1 (< \sigma_0)$ in a Normal population with a known mean μ .

b) Write a note on advantages and disadvantages of Nonparametric tests over parametric tests. (6+4)

9. a) Derive SPRTP for testing $H_0: \lambda = \lambda_0$ against $H_1: \lambda = \lambda_1 (> \lambda_0)$ in Poisson with parameter λ .

b) Explain one sample sign test. (6+4)

10. a) Describe two sample median test by deriving the distribution of the test statistic.

b) Give the test procedure of Mann Whitney U test.

(6+4)

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CREDIT BASED FOURTH SEMESTER B.Sc. DEGREE EXAMINATION APRIL 2014

STATISTICS

STATISTICAL INFERENCE

Time: 3 Hrs

Max. Marks: 80

PART - A

Answer any TEN of the following:

2X10=20

1. a) What are simple and composite hypotheses?
- b) Define level of significance and power of the test.
- c) Define most powerful test.
- d) Write the properties of LRTP.
- e) Define standard error of a statistic. Mention the mean and standard error of sample proportion.

- f) What is P-value? How do you use it in testing of hypothesis?
- g) Write a note on Fisher's Z transformation.
- h) Mention the test statistic and critical region for testing the equality of population means based on large samples.
- i) Write the instances under which Chi-square test is applicable.
- j) Write the need for sequential testing.
- k) Mention the limitations of Non Parametric Tests.
- l) What is the large sample approximation for median test?

PART – B

Answer any TWO of the following:

10x2=20

2. a) Define one tailed and two tailed tests. Give an example for each.
 - b) Derive the test statistic for paired t test and write the test procedure. (5+5)
3. a) If X has an exponential distribution with λ then find probability of type I error and type II error for testing the hypothesis $H_0: \lambda = \lambda_0$ against $H_1: \lambda = \lambda_1$, critical region being $x > k$.
 - b) Obtain BCR to test $H_0: p = p_0$ against $H_1: p = p_1$. Based on a random sample of size k from Binomial distribution with known parameter n and unknown parameter p. (5+5)
4. Derive an LRTP for testing $H_0: \mu = \mu_0$ against $H_1: \mu = \mu_1$ where μ is the mean of normal population with unknown variance σ^2 . (10)

Answer any TWO of the following:

10x2=20

5. a) Obtain the test statistic to test the equality of means of normal populations based on large sample when variances are unknown.
 - b) Let 'P' be the proportion of individuals possessing a specified characteristic in a population. Derive the large sample test for testing $H_0: p = p_0$ against $H_1: p = p_1$. (5+5)
6. a) Stating the assumptions clearly, describe the Chi-square test for goodness of fit. Identify the degrees of freedom.

b) Derive Brandt Snedekor's test statistic to test association between two attributes for contingency table. (7+3)

7. Derive an expression for test statistics to test the association of 2 attributes in contingency table. Also find the expression for Yates correction for continuity. (10)

Answer any TWO of the following:

10x2=20

8. a) Derive SPRT of strength $(1-\alpha)$ for testing H_0 against H_1 in a normal population with known variance σ^2 . Also sketch acceptance and rejection lines.

b) Mention advantages of nonparametric test. (6+4)

9. a) Derive SPRT to test H_0 against H_1 in a Poisson population with parameter λ .

b) Explain run test for randomness. (6+4)

10. a) Describe two sample sign test by deriving the distribution of the test statistic.

b) Give the procedure of Wilcoxon signed rank test. (6+4)

CREDIT BASED FOURTH SEMESTER B.COM. DEGREE EXAMINATION APRIL 2014

STATISTICS
QUANTITATIVE TECHNIQUES-II

Time: 3 Hrs

Max. Marks: 80

Note: Graph Sheets will be provided on request.

SECION - A

Answer any THREE of the following:

20X3=60

1. a) A Company manufactures two varieties A and B of pens. Each A variety pen needs 2 hours labour. Each B variety pen needs 1 hour labour. Total labour available is 500 hours per month. The demand for A variety pens is 150 per month. The demand for B variety pens is 250 per month. The profits that the two varieties fetch are Rs. 8/- and Rs. 5/- per pen. Formulate an L.P.P. (5)

- b) Solve the following LPP graphically.

Minimize $z =$

Subject to $x_1 + 2x_2 =$

400

$x_1 + x_2 =$

250

(10)

- c) At certain rate of interest compounding quarterly, a sum doubles in 4 years. Find the nominal and effective rates of interest. (5)

2. a) Using simplex method solve the following LPP:

Minimize $z =$

Subject to $x_1 + 2x_2 =$

2520

2318

x_1

(15)

- b) Obtain initial basic feasible solution to the following transportation problem using North West Corner Rule. (5)

Factory	Dealer				Capacity
	P	Q	R	S	
A	14	13	17	14	250

B	16	18	14	9	300
C	21	24	13	10	400
Required	200	225	275	250	950

3. a) A company has 5 jobs to be done on five machines. Any job can be done on any machine. The cost of doing the jobs on different machines are given below. Assign the jobs to different machines so as to minimize the total cost. **(10)**

Jobs	A	B	C	D	E
1	13	8	16	18	19
2	9	15	24	9	12
3	12	9	4	4	4
4	6	12	10	8	13
5	15	17	18	12	20

- b) Find missing value using Binomial method from the following data. **(5)**

Year :	1980	1981	1982	1983	1984	1985
Sales :	150	235	365	?	525	780

(in lakhs)

- c) A person borrowed a loan of Rs. 5000 for a specified period and at 17% compound interest he repaid Rs. 6844.50. Afterwards, he was informed that the rate of interest should have been 18%. What is the additional amount that the person should pay? **(5)**

4. a) Obtain the initial BFS by Vogel's Approximation method and hence find optimal solution to the following T.P. **(10)**

Source	Distination				Capacity
	D ₁	D ₂	D ₃	D ₄	
S ₁	19	30	50	10	7
S ₂	70	30	40	60	9
S ₃	40	8	70	20	18
Demand	5	8	7	14	

- b) From the following data find the number of factories which earn profit between Rs.40,000 and Rs. 45,000. **(10)**

Profit (Thousand rupees)	30-40	40-50	50-60	60-70	70-80
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No. of Factories	34	43	56	39	29
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SECTION - B

Answer any THREE of the following:

5X3=15

5. Define Operations Research (OR) and write its functions.
6. The cash price of an article is Rs. 11,400. The trade discount and cash discount are 20% and 5% respectively. Find the marked price.
7. The difference between true discount and banker's discount on a bill due after four months at 5% per annum is Rs. 60. Find the face value of the bill, banker's discount and true discount.
8. Find the equated due date of payment of the following bills.
Rs. 500 due on 5th July
Rs. 650 due on 20th August
Rs. 1000 due on 21st September

SECTION - C

Answer all the questions:

5x1=5

9. Define feasible solution of an LPP.
10. Define slack variables.
11. What do you mean by extrapolation?
12. When do you say that basic feasible solution is non-degenerate in a transformation problem.
13. Mr. A deposits Rs. 20,000 into a fixed deposit with Canara Bank for one year. The bank offers interest at 9%. Calculate the simple interest he will receive.

CREDIT BASED FOURTH SEMESTER B.Sc. DEGREE EXAMINATION APRIL 2015

STATISTICS

STATISTICAL INFERENCE

Time: 3 Hrs

Max. Marks: 80

PART - A

Answer any TEN of the following:

2X10=20

1. a) Define Type I and Type II errors in testing of hypothesis.
- b) What do you mean by critical region and critical value.
- c) Define Neyman Pearson's fundamental lemma.
- d) Write the assumptions under which t test is applicable.
- e) Mention two properties of LRTP.
- f) Define sample space and parametric space.
- g) Distinguish between P-Value and level of significance.
- h) When do you say a test procedure is unbiased and consistent?
- i) What are the assumptions under which Chi-square test for association of attributes can be used?
- j) What is the strength of SPRTP?
- k) What do you mean by Non-parametric tests?
- l) Write the large sample approximation for sign test?

PART - B

Answer any TWO of the following:

10x2=20

2. a) Explain null and alternative hypothesis with an example each.
- b) What do you mean by Fisher's Z transformation? Where do we use it? (4+6)
3. a) Let X_1, X_2, \dots, X_n be a random sample of size n from Bernoulli distribution with parameter p . To test $H_0: p = p_0$ against $H_1: p > p_0$ the test criteria used is to reject the null hypothesis if $\sum_{i=1}^n X_i \geq c$. Obtain size and power function of the test.
- b) Obtain BCR to test the hypothesis $H_0: \lambda = \lambda_0$ against $H_1: \lambda < \lambda_0$, when a random sample of size n is taken from Exponential population with pdf $f(x) = \lambda e^{-\lambda x}$, $x > 0$.

(5+5)

4. Derive LRTP for testing equality of variances of two independent Normal populations with unknown means. (10)

Answer any TWO of the following:

10x2=20

5. a) Obtain the test statistic to test the hypothesis $H_0: \mu = \mu_0$ against $H_1: \mu \neq \mu_0$ where μ is the mean of Normal population with unknown variance based on large samples.

- b) P_1 and P_2 are the proportion of individuals possessing a specified characteristic in two independent populations. Derive the large sample test for testing $H_0: P_1 = P_2$ against $H_1: P_1 \neq P_2$. State the critical regions for (i) $H_0: P_1 = P_2$ (ii) $H_0: P_1 > P_2$ (4+6)

6. a) Describe the Chi-square test for goodness of fit. Identify the degrees of freedom.
b) Derive an expression for testing association of attributes in contingency table.

(5+5)

7. a) Write a note on Yates correction for continuity.

- b) Derive Brandt Snedecor's formula for testing association of attributes in contingency table. (4+6)

Answer any TWO of the following:

10x2=20

8. a) Derive SPRT of strength $(1-\alpha)$ for testing $H_0: P = P_0$ against $H_1: P = P_1$ in a Bernoulli Distribution with parameter P.

- b) Distinguish between Non-parametric and Parametric tests. (6+4)

9. a) Derive SPRT to test $H_0: \mu = \mu_0$ against $H_1: \mu > \mu_0$ in a Normal population with a known mean μ_0 .

- b) Describe Wilcoxon signed rank test. (6+4)

10. a) Derive the test statistic for two sample median test.

- b) Give the test procedure of Mann Whitney U test. (5+5)

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CREDIT BASED FOURTH SEMESTER B.COM. DEGREE EXAMINATION APRIL 2015

STATISTICS
QUANTITATIVE TECHNIQUES-II

Time: 3 Hrs

Max. Marks: 80

Note: Graph Sheets will be provided on request.

SECTION - A

Answer any THREE of the following:

3X20=60

1. a) A tailor earns a profit of Rs. 15/- from a shirt and Rs. 30/- from a pant. In a week of 70 hours, he uses 40 hours for stitching and 30 hours for cutting. He requires 2 hours to stitch a shirt and 3 hours to stitch a pant. For cutting he requires one hour for a shirt and 1½ hours for a pant. Formulate the problem as an L.P.P. (5)

b) Solve the following LPP graphically.

Maximize ~~500~~
Subject to ~~500~~400
~~10~~15450
~~10~~

(10)

c) A sum of money doubles itself in 16 years. In how many years will it triple itself. (5)

2. a) Solve the following LPP using simplex method:

Maximize ~~7000~~
Subject to ~~2100~~
~~4200~~
~~300~~

(15)

b) Using North West Corner Rule find an initial basic feasible solution to the following transportation problem. (5)

Source	Destination			Availability
	X	Y	Z	
A	8	7	3	60
B	3	8	9	70

C	11	3	5	80
Required	50	80	80	210

3. a) From the data given below find the number of shops with business turn over in between 3 lakhs and 7 lakhs. **(10)**

Business Turnover (lakhs)	0-2	2-4	4-6	6-8	8-10
No. of Shops	4	3	5	6	2

- b) Solve the following assignment problem. **(10)**

	J ₁	J ₂	J ₃	J ₄	J ₅
P ₁	11	10	18	5	9
P ₂	14	13	12	19	6
P ₃	5	3	4	2	4
P ₄	15	18	17	9	12
P ₅	10	11	19	6	14

Job

Person

4. a) Find the optimal solution to the following transportation problem by finding the basic feasible solution by Vogels approximation method. **(15)**

	D ₁	D ₂	D ₃	D ₄	a _i
O ₁	5	3	6	2	19
O ₂	4	7	9	1	37
O ₃	3	4	7	5	34
b _i	16	18	31	25	90

b) From the following data find the sales figures for the year 2003 using a suitable formula.

(5)

Year	2000	2001	2002	2003	2004	2005
Sales: (000 Rs.)	126	132	150	-	148	162

c) Find compound interest and amount payable for a sum of Rs. 5000/- at 6% p.a. for 3 years compounded half yearly. What is the effective rate of interest? (5)

SECTION - B

Answer any THREE of the following:

3X5=15

5. Define interpolation and extrapolation. What are the assumptions used for interpolation. (5)
6. Find the rate of interest at which a sum doubles in 5 years compounded annually? (5)
7. A bill with face value Rs. 2500/- is due after 2 months. It is discounted through a bank at 18% p.a. Calculate Banker's gain. (5)
8. Find equated due date of following bills.
Rs. 1200 due on 6-1-2014
Rs. 800 due on 15-2-2014
Rs. 1500 due on 24-2-2014
Rs. 1000 due on 6-3-2014 (5)

SECTION - C

Answer all the questions:

5x1=5

9. Write any two applications of OR.
10. How do you find entering variable and departing variables in a simplex table?
11. Define a) Feasible solution b) Unbounded solution
12. Find the simple interest and amount payable for Rs. 1500 for 3 years at 6% p.a.
13. The rate of trade discount and cash discount on a T.V. set costing Rs. 15000/- are 4% and 3%. Find the selling price.

STA 401.1

Reg. No.

CREDIT BASED FOURTH SEMESTER B.Sc. DEGREE EXAMINATION APRIL 2016

STATISTICS
STATISTICAL INFERENCE

Time: 3 Hrs

Max. Marks: 80

PART - A

Answer any TEN of the following:

2X10=20

1. a) Distinguish between one tail and two tail tests.
- b) Define a Best Critical Region.
- c) State any two properties of MLRTP.
- d) Explain Yate's correction for continuity.
- e) What is the large sample test procedure for difference between the means of two populations?
- f) Write a note on test for correlation coefficient.
- g) How do you find degrees of freedom of Chi-square test statistics in testing goodness of fit?
- h) What is the need for sequential tests?
- i) What is meant by strength for SPRTP?
- j) Write a note on Median Test.
- k) Write down large sample approximation to sign test.
- l) What is Mann Whitney U-Test?

PART - B

Answer any TWO of the following:

10x2=20

2. a) Explain the terms
 - i) Level of significance
 - ii) Size of a Test
 - b) Derive a most powerful test of size α for testing $H_0: p = p_0$ v/s $H_1: p = p_1$ in a Bernoulli distribution. (4+6)
3. a) Derive a most powerful test of size α for testing $H_0: \mu = \mu_0$ against $H_1: \mu = \mu_1$ in $N(\mu, \sigma^2)$, σ^2 unknown.
 - b) Show that MP tests obtained using Neyman Pearson Lemma an unbiased. (5+5)

4. Of $X \sim N(\mu_1, \sigma_1^2)$, $Y \sim N(\mu_2, \sigma_2^2)$, derive MLRTP of size α for testing $H_0: \sigma_1^2 = \sigma_2^2$ against $H_1: \sigma_1^2 \neq \sigma_2^2$ when μ_1, μ_2 are unknown. (10)

Answer any TWO of the following:

10x2=20

5. a) Derive the test procedure for testing $H_0: p = p_0$ against $H_1: p \neq p_0$.
b) Write a note on paired t-test. (5+5)
6. a) Explain large sample test for difference between means.
b) Explain Yate's correction for continuity. (5+5)
7. a) Obtain the large sample test for testing $H_0: \rho_1 = \rho_2$ where ρ_1 & ρ_2 are the correlation coefficients between variates in 2 independent bivariate normal population.
b) Derive the Chi-square test of independence of attributes in a 2×2 contingency table. (5+5)

Answer any TWO of the following:

10x2=20

8. a) Explain i) Strength of SPRTP and
ii) Constants of SPRTP
b) Derive the acceptance and rejection lines for testing $H_0: P = P_0$ v/s $H_1: P = P_1 > P_0$ in a Bernoulli Distribution. (5+5)
9. a) Derive SPRTP for testing $H_0: \mu = \mu_0$ against $H_1: \mu = \mu_1 < \mu_0$ in $N(\mu, \sigma_0^2)$.
b) Describe Wilcoxon signed rank test. (6+4)
10. a) Define a Run and obtain the statistic used for Run test.
b) Derive the two sample Median test. What is the corresponding large sample test. (5+5)
