AUGUST 2005

[KN 252] **Sub. Code : 2852**

M.Sc. (Biostatistics) DEGREE EXAMINATION.

FIRSTYEAR

Paper II — RESEARCH DESIGNS AND BIOSTATISTICAL INFERENCE – I

Time : Three hours Maximum : 100 marks

Sec. A & B : Two hours and forty minutes Sec. A & B : 80 marks

Sec. C : Twenty minutes Sec. C : 20 marks

Answer Sections A and B in the **SAME** answer book.

Answer Section C in the answer sheet provided.

Answer ALL questions.

SECTION A — ($2 \times 15 = 30$ marks)

1. Let T_1 and T_2 be unbiased estimaters of $\tau(\theta)$ with efficiencies e_1 and e_2 respectively and $\rho = \rho_\theta$ be the correlation coefficient between them

$$\sqrt{e_1 e_2} - \sqrt{(1-e_1)(1-e_2)} \leq \rho \leq \sqrt{e_1 e_2} + \sqrt{(1-e_1)(1-e_2)}.$$

2. Respiratory rate (breaths per minute) was measured in eight experimental animals under three levels of exposure to carbonmonoxide. The results were as follows

	Exposure level		
Animal	Low	Moderate	High
1	36	43	45
2	33	38	39
3	35	41	33
4	39	34	39
5	41	28	33
6	41	44	26
7	44	30	39
8	45	31	29

Can one conclude on the basis of these data that the three exposure levels, on the average, have a different effect on respiratory rate? Let

$\alpha = 0.05$. Determine the P value.

SECTION B — ($10 \times 5 = 50$ marks)

3. (a) Give an example of an estimator :

(i) Which is consistent but not unbiased?

(ii) Which is unbiased but not consistent?

(b) Obtain 100 $(1-\alpha)$% confidence limits for the parameter of the Poisson distribution.

(c) If T is an unbiased estimator of a parameter, based on random sample of size n, prove that

$$Var\,(T) \geq 1/(nI(\theta))\text{, where } I(\theta)$$

is the information function.

(d) Describe the completely randomised design.

(e) Write down the basic principles for a good experimental design.

(f) State and explain the importance of random sampling.

(g) Explain briefly the role of replication, randomization and local control in the field experiments.

(h) Examine the factor which determine the sample size.

(i) Explain Likelihood ratio test. Under what circumstances would you recommend this test?

(j) Discuss the concept of interval estimation and provide suitable illustration.

SEPTEMBER 2006

[KP 252] **Sub. Code : 2852**

M.Sc. (Biostatistics) DEGREE EXAMINATION.

First Year

Paper II — RESEARCH DESIGNS AND BIOSTATISTICAL INFERENCE — I

Time : Three hours | Maximum : 100 marks

Descriptive : Two hours and forty minutes | Descriptive : 80 marks

Objective : Twenty minutes | Objective : 20 marks

Answer ALL questions.

1. Define a consistent estimator. If the estimator t_n based on a random sample of size n is such that $E(t_n)\to\theta$ and $\text{var}(t_n)\to 0$ as $n\to\infty$ then show that t_n is a consistent estimator for θ. Hence prove that the sample mean is always a consistent estimator for population mean. (20)

2 What is the principle of replication and what are the local controls? What is their role in experimental designs. (15)

3. A random sample X_1, X_2 of size 2 with replacement is taken from the following population :

Value of $X(k)$:-	0	1	2	3
Probability $P(X=k)$:	1/8	3/8	3/8	1/8

Find the distribution of X_1+X_2, its mean and variance. Also find the distribution of the sample mean X, its mean and variance. (15)

4. Write short notes on : (6 × 5 = 30)

(a) Give the mathematical model assumed in L.S.D and explain the analysis of variance table used for analysing the results of an experiment.

(b) Describe the advantages of sampling over complete enumeration.

(c) Compare the efficiencies of Neyman and proportional allocations with that of an unstratified random sample of the same size.

(d) Define MVU estimator. If T_1 and T_2 are two unbiased estimators of a parameter θ, with variances σ_1^2 and σ_2^2 and correlation coefficient ρ, obtain the best unbiased linear combination of T_1 and T_2. Also obtain its variance.

(e) Describe UMP test and likelihood ratio test.

(f) Describe the test procedure to test the equality of two population variances taking small samples. Also write down the 95% confidence interval for the ratio of population variances.

MARCH 2008

[KS 252] **Sub. Code : 2852**

M.Sc. (Biostatistics) DEGREE EXAMINATION.

First Year

Paper II — RESEARCH DESIGNS AND BIOSTATISTICAL INFERENCE – I

Q.P. Code : 282852

Time : Three hours Maximum : 100 marks

Answer ALL questions.

I. Essay : (2 × 20 = 40)

1. (a) Explain the role of controls in experiments and the different types of controls.

(b) Explain the method of determination of sample size in clinical trials by giving examples.

2. (a) State and establish Neymann – Pearson lemma.

(b) Derive the UMP test for $H_0 : \theta = \theta_0$ against $H_1 : \theta > \theta_0$ based on a random sample of size n from a distribution with the density function.

$f(x ; \theta) = \theta l^{-\theta x}$; $\theta > 0, x > 0$ Also obtain an expression for the power function.

MARCH 2008

II. Write Short notes on : (10 × 6 = 60)

(1) Distinguish between CRD and RBD. Under what conditions is a CRD used? Explain the underlying model and draw its ANOVA table.

(2) What is a latin square design? Give an example of a 4 × 4 LSD. What are the advantages of LSD over CRD and RBD?

(3) Explain the advantages of sampling over complete census method.

(4) Define a Sufficient Statistic. Show that if $X_1, X_2, \ldots . X_n$ is a random sample from a $N(\mu, \sigma^2)$ population, then $\overline{X}$ is sufficient for μ if σ^2 is known.

(5) Explain the likelihood ratio test. What are its properties?

(6) Construct a confidence Interval for the difference of proportions in populations, stating the assumptions you make.

(7) Obtain an estimate of a missing observation in a latin square experiment.

(8) Give an account of source of errors in sample surveys and the methods of controlling the same.

(9) Explain the Chi square test for testing the goodness of fit.

(10) Show that the variance of an unbiased estimator tending to zero, is sufficient for the estimator to be sufficient. Give an example of an estimator which is not consistent.

[KV 252] Sub. Code: 2852

M.Sc (BIOSTATISTICS) DEGREE EXAMINATION

FIRST YEAR

Paper II –RESEARCH DESIGNS AND BIOSTATISTICAL INFERENCE - I

Q.P. Code : 282852

Time : Three hours **Maximum : 100 marks**

Answer All questions.

I. Essays: **(2 X 20=40)**

1. a) What do you understand by 'Design of an experiment'. Describe the basic principles of an experimental design.
   b) Write down the advantages of
      i) RBD over CRD ii) LSD over RBD

2. Define i) Critical region and level of significance.
   ii) UMP unbiased test. Iii) Likelihood ratio test

II. Write Short Notes on : **(10X 6 = 60)**

1. What is meant by 'missing plot technique'? Show how to estimate a missing value in a randomized block experiment.
2. What is a Latin square design? Write down the assumptions and applications of a LSD in field experiment.
3. Describe the analysis of variance to an LSD.
4. Describe the principle steps in a sample survey.
5. Define with examples simple random sampling
   i) with replacement ii) without replacement
6. Critically compare and contrast systematic sampling with stratified sampling.
7. What do you understand by point estimation? Write down the properties of a good estimator. Give an example of consistent estimator but not unbiased estimator.
8. Obtain 99% confidence interval for the difference between two population means from small samples.
9. Write down any three application of t, f and x^2 distributions each.
10. Use Neyman Pearson Lemma to obtain the best critical region for testing $\theta = \theta_0$ against $\theta = \theta_1 > \theta_0$, in the case of a normal population $N(\theta, 6^2)$, where 6^2 is known.

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[KZ 1011] **Sub. Code: 2852**

M.Sc NON-MEDICAL DEGREE EXAMINATION
FIRST YEAR
BRANCH II - BIOSTATISTICS

PAPER II – RESEARCH DESIGNS AND BIOSTATISTICAL INFERENCE - I

Q.P. Code : 282852

Time : 3 hours **Maximum : 100 marks**
(180 Min)

Answer ALL questions in the same order.

I. Elaborate on :	**Pages (Max.)**	**Time (Max.)**	**Marks (Max.)**
1. Explain the various types of probability sampling	17	40	20
2. Properties of an estimator with suitable examples	17	40	20
II. Write notes on :			
1. Principles of experimental design	4	10	6
2. Assignable and chance causes	4	10	6
3. Types of control	4	10	6
4. Sample size determination	4	10	6
5. The convenience sampling	4	10	6
6. Confidence interval for mean and variance of normal distribution	4	10	6
7. Best linear unbiased estimator	4	10	6
8. Types of error in testing of hypothesis	4	10	6
9. Chi-square test of independence of contingency tables	4	10	6
10. Test based on "t" and "f"	4	10	6

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