AUGUST 2005

[KN 251] Sub. Code : 2851

M.Sc. (Biostatistics) DEGREE EXAMINATION.

FIRST YEAR

Paper I — PROBABILITY THEORY AND DISTRIBUTIONS

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 × 15 = 30 marks)

1. Fit a poisson distribution to the following data with respect to the number of red blood corpuscles (x) per cells : (15)

x :	0	1	2	3	4	5
Number of Cells :	142	156	69	27	5	1

AUGUST 2005

2. (a) The life time of a certain brand of an electric bulb may be considered a random variable with mean 1200 hours and standard deviation 250 hours. Find the probability using central limit theorem that the average life time of 60 bulbs exceeds 1400 hours. (10)

(b) Explain the concept of 'Convergence in probability'. (5)

SECTION B — (10 × 5 = 50 marks)

3. (a) What is a discrete random variables? Give suitable example that are of interest to the health professional.

(b) In a certain metropolitan area there is an average of one sucide per month. Find the probability that during a given month the number of suicides will be

(i) Greater than one

(ii) Less than one

(c) Explain what is meant by 'Probability space'.

(d) Two fair dice are thrown independent. Three events A, B and C are defined as follows

A : Odd face with first dice.

B : Odd face with second dice.

C : Sum of points on two dice is odd.

Are the events A, B and C mutually independent?

(e) What is the expectations of the number of failures proceeding the first successes in an infinite series of independent trials with constant probability. P of success in each trials.

(f) The mean and variance of binomial distribution are 4 and 4/3 respectively. Find $P(x \geq 1)$.

(g) Show that in a poisson distribution with unit mean, mean deviation about mean is (2/e) times the standard deviation.

(h) Let the two independent random variables x_1 and x_2 have the same, geometric distribution show that the conditional distribution of $x_1(x_1 + x_2 = n)$ is uniform.

(i) Explain properties of the wishart distribution.

(j) The simple correlation coefficient between temperature (x_1), corn yield (x_2) and rainfall (x_3) are $r_{12} = 0.59$, $r_{13} = 0.46$, and $r_{23} = 0.77$. Calculate the partial correlation coefficients $r_{12.3}$, $r_{23.1}$ and $r_{31.2}$.

SEPTEMBER 2006

[KP 251] **Sub. Code : 2851**

M.Sc. (Biostatistics) DEGREE EXAMINATION.

First Year

Paper I — PROBABILITY THEORY AND DISTRIBUTIONS

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. (a) Prove that, if X and Y are mutually independent random variables with finite expectations, the their product is a random variable with finite expectation and $E(XY) = E(X) \cdot E(Y)$. (10)

(b) Explain the use of t–distribution in biostatistical inference. (10)

2. Let X be a random variable with distribution

X :	1	3	5	7
$P(X = x)$:	0.4	0.3	0.2	0.1

(a) Find the mean μ_X, variance σ_X^2 and standard deviation of σ_X of X..

(b) Find the distribution of the standardized random variable $Z = (X - \mu)/\sigma$ of X, and show that $\mu z = 0$ and $\sigma z = 1$. (15)

3. How will you estimate a mean vector and dispersion matrix of a multivariate distribution? (15)

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

(a) Define the distribution function of a random variable. Show that it is non-decreasing, right continuous with $F(-\infty) = 0$ and $F(+\infty) = 1$.

(b) Explain convergence in probability and almost surely convergence. Show that the later implies the former.

(c) State the central limit theorem for i.i.d. (identically independently distributed) random variables. Mention its significance.

(d) Explain the log normal distribution. Explain briefly its properties and uses.

(e) Define p–variate normal distribution and state any two of its properties.

(f) Define Mahalanobis D^2 – statistic. Mention its uses.

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MARCH 2008

[KS 251] **Sub. Code : 2851**

M.Sc. (Biostatistics) DEGREE EXAMINATION.

First Year

Paper I — PROBABILITY THEORY AND DISTRIBUTIONS

Q.P. Code : 282851

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

Answer ALL questions.

I. Essays : $(2 \times 20 = 40)$

1. (a) State and prove Helly-Bray Theorem.

(b) Show that convergence in probability implies in distribution.

2. (a) Define the chi-square statistic. Write its distribution. Explain the applications of chi-square statistic.

(b) Explain the test for the equality of mean vectors of the normal populations when the covariance matrices are equal but unknown.

MARCH 2008

II. Write short notes on : $(10 \times 6 = 60)$

1. Define a random variable. Show that if X is a random variable, So is $|X|$, and give an example to show that converse need not be true.

2. If X and Y are independent random variables, show that $g(X)$ and $h(Y)$ which are functions of X and Y respectively are also independent. Is the converse true?

3. If $X > Y$ almost surely, then show that $E(X) \geq E(Y)$.

4. Define convergence in probability. Give an example of a sequence $\{X_n\}$ of random variables which converges in probability.

5. State and prove Holder's inequality.

6. Explain the logistic distribution. Mention any two of its uses in Biostatistics.

7. Write a brief note on exponential distribution.

8. Define Partial and multiple correlation coefficient. Give an example.

9. Define Mahalanobis D^2 and bring its relation to Hotellings T^2.

10. Obtain the maximum likelihood estimator of μ in the case of multivariate normal distribution $N_p(\mu, \Sigma)$

September - 2009

[KV 251] Sub. Code: 2851

M.Sc (BIOSTATISTICS) DEGREE EXAMINATION

FIRST YEAR

Paper I – PROBABILITY THEORY AND DISTRIBUTION

Q.P. Code : 282851

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

Answer All questions.

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

1. The following distribution relates to the number of accidents to 650 women working on highly explosive shells during 5 weeks period. Show that a negative binomial distribution, rather than a geometric distribution, gives a very good fit to the data. How would you explain this?

No. of accidents	:	0	1	2	3	4	5
Frequency	:	450	132	41	22	3	2

2. a) What is meant by discrete random variable. Give three example that are of interest to the health professional.
   b) Explain the term convergence in probability.

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

1. Obtain binomial distribution as a limiting case of hyper-geometric distribution.
2. Explain the concept of a) Random variables b) Independence of random variables.
3. Explain the concepts of multiple and partial correlation coefficients.
4. State and prove the central limit theorem for the sum of n independently.
5. A coin is tossed until a tail appears. What is the expectation of the number of tosses?
6. A hospital switchboard receives an average of 4 emergency calls in a 10 minute interval. What is the probability that
   a) There are at the most 2 emergency calls in a 10 minute interval.
   b) There are exactly 3 emergency calls in a 10 minute interval.
7. Ina certain developing country, 30% of the children are undernourished. In a random sample of 25 children from this area, find the probability that the number of undernourished will be
   a) Exactly 10 b) Less than 5 c) 5 or more
8. What is a hyper geometric distribution? Find the mean and variance of this distribution.
9. Two cards are drawn at random from the cards numbered 1 to 10. Find the expectation of the sum of points on two cards.
10. Explain probability discrete space with suitable illustrations.

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[KZ 1011] **Sub. Code: 2851**

M.Sc NON-MEDICAL DEGREE EXAMINATION

FIRST YEAR

BRANCH II - BIOSTATISTICS

PAPER I – PROBABILITY THEORY AND DISTRIBUTION

Q.P. Code : 282851

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. Eight coins are tossed at a time 256 times. Number of heads observed at each throw is recorded and the results are given below. Find the expected frequencies. What are the theoretical values of mean and standard deviation? Calculate also the mean and SD of observed frequencies.	17	40	20

No. of heads at throw:	0	1	2	3	4	5	6	7	8
Frequency :	2	6	30	52	67	56	32	10	1

2. (a) A husband and wife appear in an interview for two vacancies in the same post. The probability of husband's selection is 1/7 and that wife's selection is 1/5. What is the probability that I. Both of them will be selected II. Only one of them will be selected and III. None of them will be selected (b) Explain the concept of convergence in probability and almost surely convergence.	17	40	20

II. Write notes on :			
1. Explain memory less property of the exponential distribution.	4	10	6
2. Define Mahalanobis D^2 statistic and discuss its uses.	4	10	6
3. Write a brief note on log normal distribution and its uses.	4	10	6
4. Discuss properties of geometric distribution.	4	10	6
5. Explain hypergeometric distribution and give its characteristics.	4	10	6
6. Prove the reproductive property of independent Poisson random variable.	4	10	6
7. What is discrete probability space?	4	10	6
8. State the central limit theorem for identically independently distributed random variable and discuss its significance.	4	10	6
9. What is inverse formula?	4	10	6
10. Define expectation and discuss its properties.	4	10	6

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