

3/2/08

B/JI/05  
PG CO-XIV

POST-GRADUATE COURSE

Term End Examination — December, 2007

M.Com.

ADVANCED STATISTICAL  
CONCEPTS AND TOOLS

PAPER XIV

Time — 2 hours

Full marks—50

(Weightage of marks—80%)

Special credit will be given for accuracy and relevance in the answer. Marks will be deducted for incorrect spelling, untidy work and illegible handwriting. The weightage for each question has been indicated in the margin.

Group - A

Answer any two questions.

1. (a) The probabilities are .7, .3 and .2 that a potential investor will purchase shares in European stock funds, Asian stock funds, or both. Find the probability that the potential investor will invest in

- (i) at least one of the funds.
- (ii) neither of the two funds.

(b) A firm has 80% of its service calls made by a contractor and 10% of these calls result in customer complaints. The other 20% of the service calls are made by their own employees and these calls have a 5% complaint rate. Find the probability of a complaint.

(c) If A and B are two events prove that :

(i)  $P(A \setminus B) = 1 - P(A^c/B)$ ,  $P(B) > 0$

(ii)  $P(A \cap B) \leq P(A) \leq P(A \cup B)$ . 4+6+5=15

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(2)

2. A surprise quiz contains three multiple choice questions. Question 1 has three suggested answers, Question 2 has three suggested answers and Question three has two. A completely unprepared student decides to choose answers at random. Let X denote the number of questions the student answers correctly.

- (i) List the possible values of X.
- (ii) Find the probability distribution of X.
- (iii) Find P (at least one correct answer).

(b) For two random variable X and Y,  $E(X) = 50$ ,  $E(Y) = 60$ ,  $V(X) = 160$ ,  $V(Y) = 360$ ,  $\rho_{xy} = 0.75$ .

Compute :

(a)  $Cov(X + Y, Y)$

(b)  $V(5X - 3Y)$

(c) Find the value of C so that the following function can be considered as a true probability function :

$$f(x) = \frac{1}{2} \frac{1}{C} \binom{4}{x} + \frac{c}{4} \quad x = 1, 2, 3, 4$$

= 0 otherwise

6+5+4=15

3.(a) Customer arrivals at a bank are random and independent with a mean rate 2 per minute. The probability of an arrival in any 1 minute period is the same as the probability of an arrival in any other 1 minute period.

- (i) What is the probability of three or more arrivals in a 1 minute period ?
- (ii) What is the probability of at least three arrivals in a 2 minute period ?

(b) The variance of a binomial variable X is half of its mean. Calculate :

(i)  $P[X = 0]$  (ii) The skewness of the distribution.

(c) A wholesale distributor of a product finds that the annual demand for the product is normally distributed with mean 120 and s.d 16. If he orders only once a year what quantity should be ordered to ensure that there is only a 5% chance of running short ?

[given,  $\Phi(1.645) = 0.95$ ]

5+6+4=15

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- 4.(a) A population consists of the observations having values 2, 4, 6
- Enumerate all possible samples of size 2 which can be drawn from the population without replacement.
  - Show that the mean of the sampling distribution of the sample means is equal to the population mean.
  - Compute variance of the sample mean and show that it is less than the population variance.
- (b) While estimating the mean of a population how large a sample should be taken so that the probability is .95 that the estimate is not different from the population mean by more than one sixth of the population s.d. ?  
 $10+5=15$

**Group - B**

Answer any two questions.

5.(a) Distinguish between :

- Parameter & Statistic
- Standard deviation and standard error.

(b) if  $x_1, x_2, \dots, x_n$  is a sample of  $n$  independent observations from a normal population with mean  $\mu$  and variance  $\sigma^2$ , show that  $\bar{x}$  is an unbiased estimator of  $\mu$  but  $S^2 = \frac{1}{n} \sum (x_i - \bar{x})^2$  is not an unbiased estimator of  $\sigma^2$ .  $4+6=10$

6.(a) A sample of 1600 screws is taken from a large consignment. 64% of the screws were found to be defective. Assuming that the simple sampling conditions hold good, estimate the confidence limits of the proportion of defective screws.

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(4)

(b) A die was thrown 60 times. The results are summarized in the following table.

Face	1	2	3	4	5	6
Frequency	6	10	8	13	11	12

Are the data consistent with the hypothesis that the die is unbiased ?

$$[X_{5, .01}^2 = 15.09]$$

$$4+6=10$$

7.(a) Define type I and type II error in testing of hypothesis.

(b) A large consulting company estimates several components of job cost when preparing a bid. A sample of 8 bids for government projects and a sample of 8 bids for private projects provided the data on the management cost component (as a percentage of the total bid)

Government	.3	.9	1.4	2.2	2.4	3.9
Private	4.2	1.2	2.5	2.7	3.7	5.2

Treat these data as independent random samples and test whether the components of job cost is more in bidding for a private project than a government project ? Take  $\alpha = .05$ .

$$[t_{.05, 10} = 1.812]$$

$$t_{.025, 10} = 2.228] \quad 2+8=10$$

8.(a) Determine the mode of a binomial distribution.

(b) The average monthly sales of 5,000 firms are normally distributed with mean Rs. 36 lakhs and s.d. Rs. 10 lakhs. Find the number of firms having sales more than 45 lakhs.  $6+4=10$ .

You may use the following table values :

$$Z_{.005} = 2.58 \quad Z_{.01} = 2.33$$

$$Z_{.025} = 1.96 \quad Z_{.05} = 1.645$$