

Post-Graduate Course

Term End Examination - 2006

M. Com.

Advanced Statistical Concepts & Tools

Paper - XIV

Time : Two 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* from the following questions.

1. a) The events M and N are such that

$$P(M) = P(N) = 2P(M \cap N). \text{ Given that}$$

$$P(M \cup N) = 0.6 \text{ find}$$

$$P(M \cap N), P(M)$$

$$P(M' \cap N'), P(M \cap N')$$

b) The random variable X has the following distribution.

x :	1	2	3
P(X = x) :	a	b	a

Where a, b are constants.

i) Write down E (X)

ii) Given that $\text{Var}(X) = 0.75$, find the values of a and b.

8+7=15

P.T.O.

2. a) At an electronics plant it is known from past experience that the probability is 0.86 that a new worker who has attended the company's training program will meet his production quota, and that the corresponding probability is 0.35 for a new worker who has not attended the company's training program. If 80% of all new workers attend the training program, what is the probability that a new worker will meet his production quota ?

b) Show that the binomial distribution is symmetric when $P=1/2$.

c) If A and B are independent, then show that A^c and B^c are also independent. $6+6+3$

3. a) The thickness of some sheets of wood follows a normal distribution with mean μ and standard deviation σ . 96% of the sheets will go through a 8 mm gauge while only 1.7% will go through a 7 mm gauge. Find μ and σ .

b) A random sample of size 20 from a $N(\mu, \sigma^2)$ yielded a sample variance of 25. What is the probability that the sample mean will not differ from the population mean by more than 4 in absolute value ? $8+7=15$

4. a) Discuss type I and type II error in the context of Testing of Hypothesis.

b) As part of an industrial training program some trainees are instructed by method A, which is straight teaching—machine instruction, and some are instructed by method B which also involves the personal attention of an instructor. If random samples of size 10 are taken from large groups of trainees instructed by each of these two methods, and the scores which they obtained in an

achievement test are,

Method A : 71 75 65 69 73 66

Method B : 72 77 84 78 69 70

Test the claim that method B is more effective at $\alpha = 0.05$. 5+10=15

$$[t_{10, .05} = 1.812, t_{5, .05} = 2.015]$$

Group — B

Answer *any two* from the following questions.

5. a) A discrete random variable Y has the following probability distribution.

x : 1 2 3 4

P(X = x) : $\frac{1}{3}$ $\frac{1}{3}$ K $\frac{1}{4}$

i) Find the value of K.

ii) Find P (X ≤ 3)

- b) The probability that a door-to-door salesman convinces a customer to buy is 0.7. Assuming sales are independent find the probability that the salesman makes a sale before reaching the fourth house.

$$4+6=10$$

6. a) Describe the following methods of sampling with suitable examples.

i) Stratified Sampling

ii) Multistage Sampling

- b) In a random sample of 60 claims filed against a company writing collision insurance on cars, 21 claims exceeded Rs. 12000. Construct a 0.99 confidence interval for the corresponding true proportion. 5+5=10

7. a) In a large government agency, illness is given one times in nine as the reason for all absences from work. What is the probability that three of four absences were claimed to be due to illness ?

b) Five fair coins were tossed 100 times. From the following outcomes fit a binominal distribution and calculate the expected frequencies.

Number of heads	0	1	2	3	4	5
Observed frequency	2	10	24	38	18	8

$$5+5=10$$

8. a) In order to investigate whether there is a relationship between real-estate salespersons' standard of clothing and their success in their jobs, a random sample of 350 real-estate persons taken from a certain city area, yielded the following table.

	Success in job		
	Below average	Average	Above average
Poorly dressed	19	17	6
Well dressed	27	35	21
Very well dressed	30	137	58

Draw your conclusion based on the above data. Do the test at $\alpha = 0.99$ level of significance. [$\chi^2_{4, .01} = 13.277$]

b) Past data indicate that the variance of measurements made on sheet metal stampings by experienced inspectors is 0.18 square inch. If a new inspector measures 100 stampings with a variance of 0.25 square inch test at the 0.05 level of significance whether the inspector is making satisfactory measurements. _____

$$7+3=10$$