POST-GRADUATE COURSE

**Term End Examination — December, 2008**

**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 : 15×2=30

1.(a) For any two events A and B prove that

$$P(A\cap B)\le P(A)\le P(A\cup B)\le P(A)+P(B)$$

(b) State and prove Bayes' theorem on conditional probability. 7+8=15

2.(a) If $P(A)=\frac{1}{4}$, $P(B)=\frac{2}{5}$, $P(A\cap B)=\frac{1}{7}$, find

(i) $P(A\cup B)$ (ii) $P(A'\cap B')$

(iii) $P(A\cap B')$ (iv) $P(A'\cup B')$

(b) A company has 3 plants to manufacture 8,000 scooters in a month. Plant-I, II and III manufactures 3500, 2500 and 2000 respectively per month. 85%, 94% and 90%





scooters are rated standard quality in plant I, II and III respectively. What is the probability that a scooter selected at random comes from plant III if it is known that the scooter is of standard quality. 8+7=15

3.(a) A discrete random variable X has the following p.m.f.

| X : | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| P(X) : | 3a | 5a | 7a | 8a | 10a | 6a | 9a |

(i) Determine the value of 'a'

(ii) Find $P[2 \le X \le 6]$

(iii) Compute E(X)

(b) The KMC installed 2,000 bulbs in a street of Kolkata. If there bulbs have an average life of 1000 burning hours and standard deviation of 200 hrs. What number of bulbs might be expected to fail between 700 and 1300 hours ? $[\Phi(1{\cdot}5) = 0{\cdot}9332]$ 9+6=15

4.(a) Show that mean and variance of the Poisson distribution are equal.

(b) The screws manufactured by a certain machine were checked by examining sample of 8 screws. The following frequency distribution gives 200 samples according to the number of defective screws they contain. Fit a binomial distribution to the given data.

| Defective Screws : | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| No. of Samples : | 2 | 10 | 24 | 38 | 48 | 35 | 25 | 12 | 6 |

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## Group – B

Answer **any two** questions : 10×2=20

5.(a) Describe the following methods of sampling with suitable business examples.

(i) Systematic sampling.

(ii) Stratified sampling.

(b) Define standard error of an estimator. 8+2=10

6.(a) What are the advantages of sample surveys over complete enumeration (census) ?

(b) Show that sample proportion is an unbiased estimator of population proportion. Also obtain the expression for its standard error. 5+5=10

7.(a) Distinguish between (any two) :

(i) Parameter and Statistic.

(ii) Type-I error and Type-II error.

(iii) Critical Region and Acceptance Region.

(b) If $T_1$, $T_2$ and $T_3$ are 3 statistics with expectations

$E(T_1) = 3\theta_1 + 2\theta_2 + \theta_3$

$E(T_2) = 2\theta_1 + 3\theta_2 + \theta_3$

and $E(T_3) = \theta_1 + \theta_2 + \theta_3$

Find unbiased estimator of $\theta_1$, $\theta_2$ and $\theta_3$ 6+4=10

8.(a) Two types of batteries are tested for their length of life and the following data are obtained

| **Type** | **Sample size** | **Meanlife**(hr) | **Variance** |
|---|---|---|---|
| A | 9 | 900 | 256 |
| B | 8 | 1150 | 325 |

Is there a significant difference in the two means?

$[t_{15\ ;\ 0{\cdot}05} = 2{\cdot}131]$