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(Residential Autonomous College under University of Calcutta)

B.A./B.SC. FIRST SEMESTER EXAMINATION, DECEMBER 2011

FIRST YEAR

Date : 23/12/2011 **STATISTICS (General)**

Time : 10.30am – 12.30pm Paper : I Full Marks : 50

[Use separate answer-books for each group]

Group – A

1. Answer **any three** questions:– 5 x 3 = 15
   a) Explain, with suitable examples, the distinction
      (i) between an attribute and a variable.
      (ii) between a discrete variable and a continuous variable. 5
   b) What do you mean by histogram? Describe how it is constructed. 5
   c) What is factor reversal test? Show that Fisher's index number satisfies factor reversal test. 5
   d) State the characteristics of a satisfactory measure of central tendency. 5
   e) For a set of 250 observations on a certain variable *x*, the mean and standard deviation are 65.7 and 4.4 respectively. However, on scrutinizing data it is found that two observations which should correctly be read as 71 and 83, had been wrongly recorded as 91 and 80. Obtain the correct values of the mean and standard deviation. 5
   f) Define skewness. Show that Bowley's measure of skewness lies between –1 and +1. 5

2. Answer **any one** question:– 10 x 1 = 10
   a) (i) Show that the mean deviation is least when measured about median. 6+4
      (ii) Show that the standard deviation is independent of change in origin but depends on change in scale.
   b) Obtain the standard deviation of first *n* natural numbers. Hence obtain the standard deviation of first *n* odd numbers.
      Suppose that the variable *x* takes positive value only and that the deviations $x_i - \bar{x}$ are small compared to $\bar{x}$. Show that in such a case $x_g \simeq \bar{x}\left(1-\frac{s^2}{2\bar{x}^2}\right)$, where x_g is the geometric mean and *s* is the standard deviation. 3+2+5

Group – B

3. Answer **any three** questions:– 5 x 3 = 15
   a) Write the following events in set theoretic notations:
      (i) occurrence of at least one of the events A, B and C
      (ii) occurrence of exactly one of the events A, B and C
      (iii) occurrence of at least two of the events A, B and C 5
   b) Let $P(A) = 0.4$ and $P(A \bigcup B) = 0.7$. Find $P(B)$ if (i) A and B are independent; (ii) A and B are mutually exclusive. 5
   c) Define a random variable, p.m.f and cumulative distribution function. 5
   d) A bag contains 5 white and 3 black balls. Three balls are drawn randomly, without replacement from the bag. If *X* is a random variable which takes the value 1, if at least two white balls are drawn and the value 0, otherwise, find *E*(*X*). 5
   e) Given $P(A) = p, P(B \mid A) = P(B^c \mid A^C) = 1 - p$, show that $P(A \mid B)$ is independent of *p*. Find $P(A^c \mid B^c)$. 5

f) If X and Y are two independent random Variables with expectations λ_1 and λ_2 respectively, show that

$$V(XY) = \lambda_1^2 \lambda_2^2 (C_x^2 + C_y^2 + C_x^2 C_y^2),$$

where $\lambda_1^2 C_x^2 = V(X)$ and $\lambda_2^2 C_y^2 = V(Y)$. 5

4. Answer **<u>any one</u>** question:– 10 x 1 = 10

a) State Bayes' theorem.
Three boxes of same appearance have the following contents :
Box-I : 1 white, 3 black balls.
Box-II : 2 white, 2 black balls.
Box-III : 3 white, 1 black ball.
One of the boxes is selected at random and one ball is randomly drawn from it. If it turns out to be white, what is the probability that it is taken from Box-III? 2+8

b) Find the mode of a binomial distribution with parameters n and p.
Show that a binomial distribution with parameters n and p can be well approximated by a Poisson distribution with parameter λ when $n \to \infty$ and $p \to 0$ such that $np = \lambda$, a finite quantity. 5+5
