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SARDAR PATEL UNIVERSITY
M.Sc. (I Semester) Examination
2012
Tuesday, 4th December
10:30 a.m. to 1:30 p.m.
STATISTICS COURSE No. PS01CSTA03
(Distribution Theory)

Notes: Figures to the right indicate marks. (Total marks: 70)

1 Wright the correct answer (each question carries one mark). **08**

(a) A non-central chi-square distribution is a
(i) weighted sum of chi-square variables with weight as Poisson probabilities
(ii) weighted sum of Poisson variables with weight as chi-square probabilities
(iii) compound distribution of Poisson and chi-square distributions
(iv) (i) and (iii) but (ii)

(b) Height of a person follows normal distribution. A person having minimum height 65" is qualified for the post of PSI, then the distribution of height of a person qualified for PSI follows
(i) Normal distribution (ii) mixture of two distribution
(iii) right truncated normal distribution (iv) left truncated normal distribution

(c) A correlation coefficient between height and a joint effect of weight and age is known as,
(i) Karl-Pearson correlation coefficient
(ii) Spearman's rank correlation coefficient
(iii) Multiple correlation coefficient
(iv) Partial correlation coefficient

(d) The multinomial variates are
(i) negatively correlated (ii) positively correlated
(iii) perfect positively correlated (iv) perfect negatively correlated

(e) Let $X \sim N_p(\underline{\mu}, \Sigma)$. Then
(i) all X_i's are independent (ii) all X_i's are identically distributed
(iii) all X_i's are iid random variables (iv) none of the above

(f) Let $X \sim N_p(\underline{\mu}, I)$ then $\underline{X}'A\underline{X}$ and $\underline{X}'B\underline{X}$ are independent iff
(i) AB = 0 (ii) BA = 0 (iii) AB = BA = 0 (iv) None of these

(g) A test statistic used in sign-test follows
(i) Bernoulli distribution (ii) Poisson distribution
(iii) Binomial distribution (iv) Normal distribution

(h) Rank order statistics are
(i) normally distributed (ii) uniformly distributed
(iii) exponentially distributed (iv) none of the above

2 Answer any SEVEN of the following (each question carries two marks) **14**

(a) Let $X \sim \chi^2(1, \lambda)$ and $Y \sim \chi^2(m)$ be independently distributed. Obtain the distribution of $X+Y$.

(b) If $F \sim F(m,n;\lambda)$ then obtain the distribution of $B=\frac{m}{n}F$.

(c) Obtain mgf of a chi-square distribution.

(d) Let X follows poison distribution with mean λ. It is given that X never assumes the values 0 and 1 then fine E(X) under this condition.

(e) Find the pdf of $X_{(1)}$ for the exponential distribution with mean θ (θ > 0).

(f) Find the distribution of range R based on a random sample of size n from U(0, θ) uniform distribution.

(g) Obtain mgf of a multinomial distribution.

(h) Let $\begin{pmatrix} X \\ Y \\ Z \end{pmatrix} \sim N\left(\begin{pmatrix} 2 \\ -3 \\ 5 \end{pmatrix}, \begin{bmatrix} 4 & 1 & 0 \\ 1 & 9 & -1 \\ 0 & -1 & 16 \end{bmatrix}\right)$. Obtain the joint distribution of p = 2X – 4Z and q = X + Y – Z.

(i) For the distribution given in 2(h), find $\rho_{xy.z}$ and $\rho_{xy.z}$.

3 (a) Define non central chi-square variate and obtain its pdf. **06**

(b) Define non central t variate and obtain its pdf. **06**

OR

(b) Define non central F statistic and derive its pdf. **06**

4 (a) What is compound distribution? Obtain unconditional distribution of X when $X \sim b(n,p)$ and p follows beta type I distribution with parameters a and b. **06**

(b) What do you mean by distribution free statistic? Show that the area under the density function between any two ordered observations is distributed as beta with appropriate parameters. **06**

OR

(b) Discuss applications of rank ordered statistics. **06**

5 (a) Define partial correlation. State and derive expressions for partial correlation coefficient. **06**

(b) Define multinomial distribution. Obtain variance covariance matrix of the distribution. Check whether it is p.d. or p.s.d. **06**

OR

(b) Discuss: Transformation of statistics and its roll. **06**

6 (a) Define multivariate normal distribution. State its properties (known to you) and show that the conditional distribution of any sub-vector of normal vector given the remaining components is normal. **06**

(b) Let $\underline{X} \sim N_3(\underline{\mu},\Sigma)$ and its pdf is $f(\underline{x}) = Ke^{-Q/2}$, where **06**
$Q = 7X_1^2 + 4X_2^2 + 2X_3^2 + 6X_1X_2 + 2X_3X_2 + 4X_1X_3$
Find constant K and P($X_1 > X_3$).

OR

(b) Let $\underline{X}: p\times 1 \sim N_p(\underline{\mu},\Sigma)$. Stating the conditions, obtain the distribution of the quadratic form $\underline{X}' A \underline{X}$. **06**

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