MA 5160 Applied Probability and Statistics

Important 2 Mark Questions

Unit I

1. A family has two children. What is the probability that both are boys given that at least one of them is a boy?
2. A random variable X has the probability function $f(x) = \frac{1}{2^x}, x = 1, 2, 3, ...$Find its Moment generating function.
3. A continuous random variable X follows the probability law $f(x) = Ax^2, 0 \leq x \leq 1$. Determine A and find the probability that x lies between 0.2 and 0.5.
4. If, on an average, 9 ships out of 10 arrive safely to a port, obtain the mean and standard deviation of the number of ships returning safely out of 150 ships.
5. If X is the Poisson random variable such that $P[X = 1] = P[X = 2]$, find $E[X]$.
6. Find the mean and variance of Binomial distribution.
7. If the probability density function of a variable X is $f(x) = \frac{x}{2}$ for $0 < x < 2$, find $P[X > 1.5/X > 1]$.
8. If X is uniformly distributed in (1, 2), find the probability density function of $Y = e^x$.
9. The mean of a binomial distribution is 20 and standard deviation is 4. Find the parameters of the distribution.
10. A continuous random variable X has the pdf. f(x) given by $f(x) = \{2x \; if \; 0 < x < 1$
    0 otherwise

Unit II

1. A joint probability density function of the random variable (X, Y) is given by $f(x, y) = 4xye^{-(x^2+y^2)}, x > 0, y > 0$. Prove that X and Y are independent.
2. If X has mean 4 and variance 9, while Y has mean -2 and variance 5 and the two variables are independent, Find $E(XY)^2$.
3. What are the marginal density function of two-dimensional random variables X and Y.
4. If the joint pdf of (X, Y) is given by $f(x, y) = x + y; 0 < x, y < 1$. Find E(XY).
5. Find the value of k and E(XY), if $f(x, y) = k(1 = x)(1 - y): 0 < x < 1, 0 < y < 1$ is a joint probability density function of two-dimensional continuous random variable (X, Y).
6. When will the two regression lines be at right angles?
7. State any two properties of correlation coefficient.
8. If $U = X + Y$ and $V = X - Y$, how are the joint probability density function of (X, Y) and (U, V) related?
9. If X and Y are independent random variables, then show that $Cov\,(X, y) = 0$.
10. If the joint pmf of X and Y is given by $P(x, y) = \{k(x + y), x = 0, 1, 2, y = 1, 2$
    0, otherwise

Unit III

1. Define an Unbiased estimator.
2. What is meant by the least squares method?
3. Write any two properties of regression coefficient.
4. What is meant by maximum likelihood estimator?
5. Find the maximum likelihood estimators for the population mean when the population variance is known for random sampling from a normal population.
6. State any two properties of regression lines.
7. If T is an unbiased estimator for θ, then show that T^2 is a biased estimator for θ^2.
8. Why there are two regression lines for a given bivariate data? Under what conditions the two regression lines coincide?
9. The following observations constitute a random sample from an unknown population. Estimate the mean and standard deviation of the population. Also, find the estimate of standard error of sample mean. 14, 19, 17, 20, 25.
10. Two variables X and Y have the regression lines $3X + 2Y - 26 = 0$ and $6X + Y - 31 = 0$. Find the mean values of X and Y.

Unit IV

1. Write any two applications of chi-square test.
2. A random sample of 500 robots was taken from an automobile consignment and 65 were found to be improperly built robots. Find the percentage of the improperly built robots in the consignment.
3. Explain Type I and Type II errors with examples.
4. What is the use of F distribution?
5. Distinguish between parameter and statistic.
6. What are Type I and Type II errors in testing statistical hypothesis?
7. A sample of 10 gave a mean of 4.38 and a S.D of 0.06. Find at 95% confidence limits for the population mean.
8. Write any two uses of $\varkappa^2$ distribution.
9. Write the standard error of any four sampling statistics.
10. Give the value of $\varkappa^2$ for a 2×2 contingency table with cell frequencies a, b, c and d.

Unit V

1. Compute expected values for discrete random vector $X' = [X_1, X_2]$ where $E(X_1) = 0.1$ and $E(X_2) = 0.2$.
2. Define first principle component.
3. Define: Random vectors and random matrices.
4. State any two properties of Multi Variate Normal Distribution.
5. Explain mean vectors and covariance matrices.
6. Define the expected value of a random matrix.
7. If $\Sigma = \begin{vmatrix} 4 & 1 & 2 \\ 1 & 9 & -3 \\ 2 & -3 & 25 \end{vmatrix}$ and $V^{\frac{1}{2}} = \begin{vmatrix} 2 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 5 \end{vmatrix}$. Find ρ.
8. Define second principle component.

9. If X_1 and X_2 are two uncorrelated random variables, then what is the correlation coefficient matrix?
10. What is the i^{th} principle component of the standardized variables $Z' = (z_{1,} z_{2,\dots} z_p)$ with $cov(z)$ =correlation matrix ρ of X