1. A card is drawn at random from 52 playing cards. Find the probability that the card is,
   a. An Ace
   b. A Six or a Heart
   c. Neither a Nine nor Spade
2. Compute the pdf for the binomial random variable with parameters (n, p). for p=0.6, n=4.
3. If the density function of a continuous RV X is given by, Find the value of a.

$$f(x) = \begin{cases} ax & 0 \le x \le 1 \\ a & 1 \le x \le 2 \\ 3a - ax & 2 \le x \le 3 \end{cases}$$

4. Define: a. Random Variable   b. Joint Probability   c. Conditional Probability   d. Theorem of Total Probability
5. Prove that

$$a)\ C_{XY} = E\{XY\} - E\{X\}E\{Y\} \qquad b)\ |\rho_{XY}| \le 1$$

6. Explain the axiomatic definition of probability along with axioms.
7. A discrete RV has following probability distribution

x	0	1	2	3
P(x)	k	3k	5k	7k

   Find the value of k, P(X<2) and distribution function of X.
8. Write notes on

   a. Joint Probability

   b. Conditional Probability

   c. Independence

   d. Theorem of total probability

9. Write notes on

   a. Normal Distribution

   b. Binomial Distribution

   c. Geometric Distribution

   d. Poisson Distribution

   e. Negative Binomial Distribution

10. A fair coin is tossed 4 times. Define the sample space corresponding to this random experiment. Also give the subsets corresponding to the following events and find the respective probabilities.
    i.   More Heads than Tails are obtained
    ii. Tails occurred on the even numbered tosses
11. State and prove Bayes theorem.
12. Define Random variable, Random vector, Mean vector
13. State Bernoulli's theorem on independent trials.
14. State and explain Probability density function along with its properties.

15. State and explain Cumulative distribution function along with its properties.
16. A discrete RV has following probability distribution

x	0	1	2	3	4	5	6	7
P(x)	k	2k	2k	3k	K^2	$2K^2$	$3K^2$	$5K^2$

Find the value of k, P(1.5<X<4.5/X>2) and smallest value of λ for which P(X<= λ)>1/2

17. A continuous random variable X that can assume any value between $x = 2$ and $x = 5$ has a density function given by $f_X(x) = k(1 + x)$. Find the value of $p(X < 4)$.

18. One out of 5 students at a local college say that they skip breakfast in the morning. Find the mean, variance and standard deviation if 10 students are randomly selected.

19. Let V be the continuous complex valued function on unit interval $0 \le t \le 1$ Given
$\langle f(t), g(t) \rangle = \int_0^1 f(t)\, \overline{g(t)}\, dt$. State whether it is valid Inner product or not.

20. Write short notes on
    a. Schwarz Inequality
    b. Moments

21. State and explain along with mathematical formulae
    a. Almost sure convergence
    b. Convergence in r^{th} mean
    c. Convergence in probability

22. Explain in detail Law of large numbers.
23. State and explain Central limit theorem.