1. If the probability density function of a random variable is given by

$$f(x) = \begin{cases} k(1 - x^2), & \text{if } 0 \leq x \leq 1 \\ 0, & \text{elsewhere} \end{cases}$$

   find the value of k and the probabilities that a random variable take values
   (i) Between 0.1 and 0.2
   (ii) Greater than 0.5
   (iii) Mean and Variance

2. Let the random variable X assume the value r with the probability density function given by
   $P(x = r) = q^{r-1}p, \ r = 1, 2, 3$. Find the $m.g.f$ of X and hence its mean and variance.

3. A bag contains 8 items of which 2 are defective. A man selects 3 items at random. Find the expected number of defective items he has drawn

4. If the probability density function is given as,

$$f(x) = \begin{cases} kx^3, & \text{if } 0 \leq x \leq 3 \\ 0, & \text{elsewhere} \end{cases}$$

   Find the value of k and probabilities between $x = \frac{1}{2}$ and $x = \frac{3}{2}$.

5. An insurance company has discovered that only 0.1% of the population is involved in a certain type of accident every year. If its 1000 policy holders are selected at random from the population. What is the probability that not more than 5 of its clients are involved in such accidents every year. (Use $e^{-1} = 0.3668$)

6. A student takes a true-false examination consisting of 8 questions. He guesses each answer. The guesses are made at random. Find the smallest value of n so that the probability of guessing at least n correct answers is less than $\frac{1}{2}$.

7. Find the m.g.f of a random variable X having joint density function defined as follows,

$$f(x) = \begin{cases} \frac{1}{3}, & \text{if } -1 < x < 2 \\ 0, & \text{elsewhere} \end{cases}$$

8. Find k, so that $f(x, y) = k(x + y), 0 < x < 1, 0 < y < 1$ is a joint probability density function.