

Advance Engineering Mathematics(AEM)

**Branch :Information Technology,
Sem:IIIrd**



Dr. Kashish Parwani
Associate Professor, Dept. of Mathematics
JECRC, Sitapura Jaipur

Vision of the Institute

To become a renowned centre of outcome based learning, and work towards academic, professional, cultural and social enrichment of the lives of individuals and communities

Dr. Kashish Parwani

Associate Professor (Mathematics), JECRC, Jaipur

Mission of the Institute

- Focus on evaluation of learning outcomes and motivate students to inculcate research aptitude by project based learning.
- Identify, based on informed perception of Indian, regional and global needs, the areas of focus and provide platform to gain knowledge and solutions.
- Offer opportunities for interaction between academia and industry.
- Develop human potential to its fullest extent so that intellectually capable and imaginatively gifted leaders may emerge.

Dr. Kashish Parwani

Associate Professor (Mathematics, JECRC, Jaipur)

Course Outcomes

- **CO1:** To learn the concepts and principles of Random variables and Probability distribution.
- **CO2:** To learn the formulation of different mathematical problems into optimization problems.
- **CO3:** Apply the principles of optimization using differential calculus.
- **CO4:** To understand the concepts of Linear Programming.

Probability Density Function

The function $f(x)$ for a continuous random variable X is said to be probability density function (p.d.f.) provided it satisfies the following conditions:

(i) $f(x) \geq 0$; $-\infty < x < \infty$

(ii) $\int_{-\infty}^{\infty} f(x) dx = 1$

Moreover $P(a \leq X \leq b) = \int_a^b f(x) dx$

Example 1. Is the following function is a p.d.f.

$$f(x) = \begin{cases} \frac{x^2}{9} & ; 0 \leq x \leq 3 \\ 0 & ; \text{elsewhere} \end{cases}$$

Solution : $f(x)$ will be a p.d.f. if $f(x) \geq 0, \forall x$ and

$$\int_{-\infty}^{\infty} f(x) dx = 1$$

$$\text{so } \int_{-\infty}^{\infty} f(x) dx = 1 \Rightarrow \int_0^3 \frac{x^2}{9} dx = 1 \Rightarrow \left(\frac{x^3}{27} \right)_0^3 = 1$$

$$\text{clearly, } f(x) \geq 0, \forall x \text{ and } \int_{-\infty}^{\infty} f(x) dx = 1$$

So $f(x)$ will be a p.d.f.

Example . The distribution function of the random variable X is given by

$$F_X(x) = \begin{cases} 0 & ; x < 2 \\ \alpha(x - 2) & ; 2 \leq x < 6 \\ 1 & ; x \geq 6 \end{cases}$$

- Find α (b) $P(X > 4)$ (c) $P(3 \leq X \leq 5)$

Solution (a) By the definition of distribution function;

$$F_X(6) = 1 \Rightarrow \alpha(6 - 2) = 1 \Rightarrow \alpha = \frac{1}{4}$$

$$(b) \quad P(X > 4) = 1 - P[X \leq 4] = 1 - F_X(4) = 1 - \frac{1}{4}(4 - 2) = \frac{1}{2}$$

$$(c) \quad P[3 \leq X \leq 5] = F_X(5) - F_X(3) = \frac{1}{4}\{(5 - 2) - (3 - 2)\} = \frac{1}{2}$$

Examples : 3.

From a lot of 10 Items containing 3 defectives, a sample of 4 items is drawn at random. If the sample is drawn without replacement and the random variable X denotes the number of defective items in the sample. Find

(i) The probability distribution of X

(ii) $P(X \leq 1)$

(iii) $P(X > 1)$

(iv) $P(0 > X > 2)$

Solution : Clearly random variable X can take values 0, 1, 2, 3.

So $P(X=0)=$

$$\frac{{}^7C_4}{{}^{10}C_4} = \frac{7 \cdot 6 \cdot 5 \cdot 4}{1 \cdot 2 \cdot 3 \cdot 4} \times \frac{1 \cdot 2 \cdot 3 \cdot 4}{10 \cdot 9 \cdot 8 \cdot 7} = \frac{1}{6}$$

$$P(X=1) = \frac{{}^3C_1 {}^7C_3}{{}^{10}C_4}$$

$$\text{And } P(X=2) = \frac{{}^3C_2 {}^7C_2}{{}^{10}C_4} = \frac{3}{10}$$

$$P(X=3) = \frac{{}^3C_3 {}^7C_1}{{}^{10}C_4} = \frac{1}{30}$$

Hence required probability distribution will be

X	0	1	2	3
(P(X))	1/6	1/2	3/10	1/30

(ii) $P(X \leq 1) = P(X=0) + P(X=1) = 2/3$

(iii) $P(X > 1) = 1 - P(X \leq 1) = 1 - \frac{2}{3} = \frac{1}{3}$

(iv) $P(0 < X < 2) = P(X=1) = 1/2$

*Thank
You!*

Dr. Kashish Parwani
Associate Professor (Mathematics, JECRC, Jaipur)

References:

1. <https://www.slideshare.net/lovemucheca/random-variable-and-distribution>
2. <https://www.youtube.com/watch?v=UftY0e2ilM4>
3. <https://www.digimat.in/nptel/courses/video/117104117/L01.html>