# Discrete Probability Distribution

If a variable X can assume a discrete set of values $x_1, x_2, \ldots.., x_K$ with respective probabilities $p_1, p_2, \ldots, p_k$ where

$$p_1 + p_2 + \ldots.. + p_K = 1,$$

we say that a discrete probability distribution for X.

Consider, Two dice are thrown

| | | | | | |
|---|---|---|---|---|---|
| ( 1 , 1 ) | ( 1 , 2 ) | ( 1 , 3 ) | ( 1 , 4 ) | ( 1 , 5 ) | ( 1 , 6 ) |
| ( 2 , 1 ) | ( 2 , 2 ) | ( 2 , 3 ) | ( 2 , 4 ) | ( 2 , 5 ) | ( 2 , 6 ) |
| ( 3 , 1 ) | ( 3 , 2 ) | ( 3 , 3 ) | ( 3 , 4 ) | ( 3 , 5 ) | ( 3 , 6 ) |
| ( 4 , 1 ) | ( 4 , 2 ) | ( 4 , 3 ) | ( 4 , 4 ) | ( 4 , 5 ) | ( 4 , 6 ) |
| ( 5 , 1 ) | ( 5 , 2 ) | ( 5 , 3 ) | ( 5 , 4 ) | ( 5 , 5 ) | ( 5 , 6 ) |
| ( 6 , 1 ) | ( 6 , 2 ) | ( 6 , 3 ) | ( 6 , 4 ) | ( 6 , 5 ) | ( 6 , 6 ) |

**Let X be the sum of score on the dice**

$$P_n = P(x = n)$$

$$P_2 = \frac{1}{36}, \quad P_3 = \frac{2}{36}, \quad P_4 = \frac{3}{36}, \quad P_5 = \frac{4}{36}, \quad P_6 = \frac{5}{36}$$

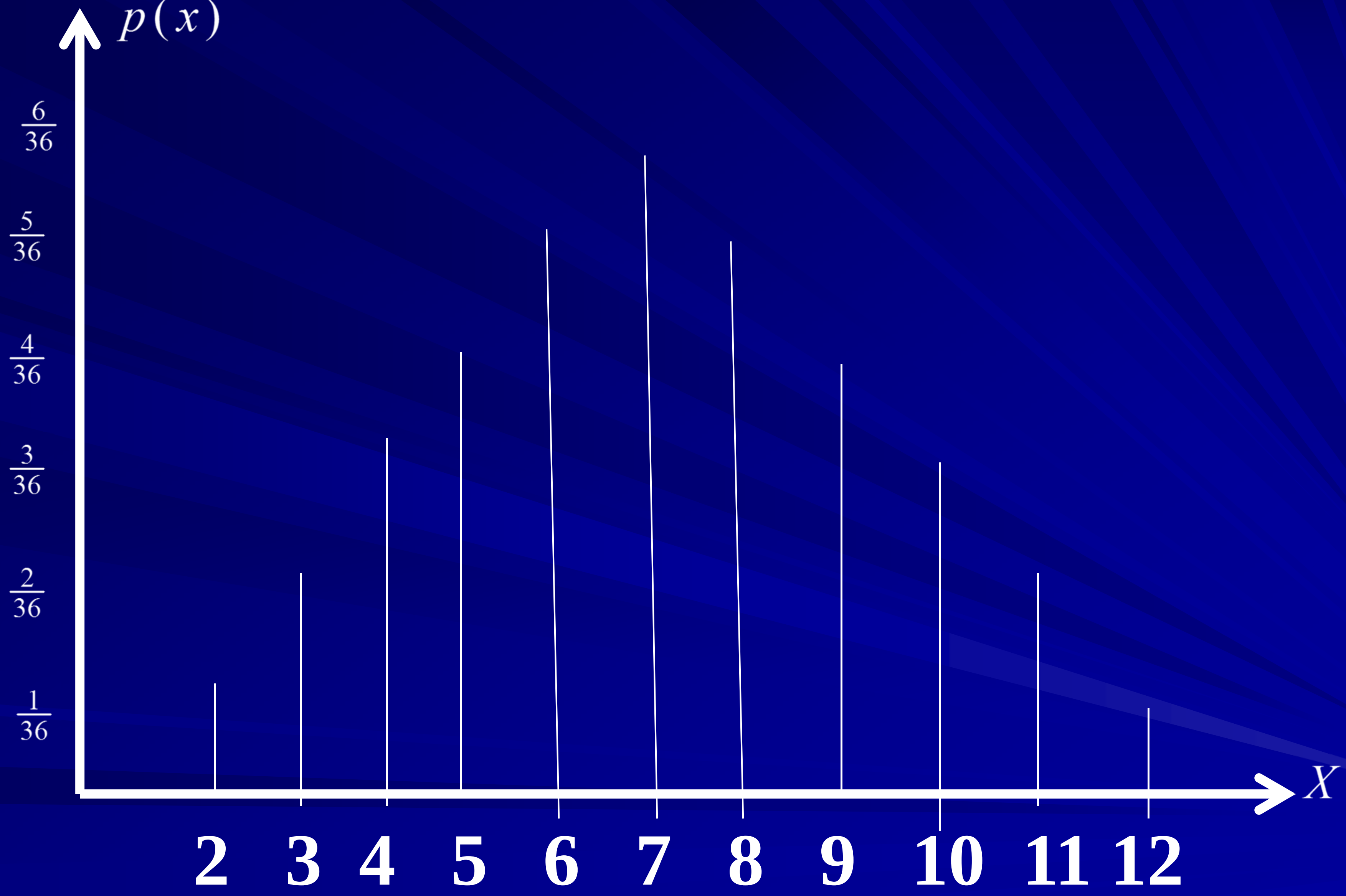
$$P_7 = \frac{6}{36}$$

$$P_8 = \frac{5}{36}, \quad P_9 = \frac{4}{36}, \quad P_{10} = \frac{3}{36}, \quad P_{11} = \frac{2}{36}, \quad P_{12} = \frac{1}{36}$$

| X | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| P(X) | $\frac{1}{36}$ | $\frac{2}{36}$ | $\frac{3}{36}$ | $\frac{4}{36}$ | $\frac{5}{36}$ | $\frac{6}{36}$ | $\frac{5}{36}$ | $\frac{4}{36}$ | $\frac{3}{36}$ | $\frac{2}{36}$ | $\frac{1}{36}$ |

$$p(x) = \begin{cases} \frac{j-1}{36} & , \ j = 2,3,4,5,6,7 \\ \frac{13-j}{36} & , \ j=8,9,10,1112 \\ 0 & , \ otherwise \end{cases}$$

# Graph



# Mathematical Expectation

**( mean , average )**

$$\mu = E(X) = p_1.x_1 + \ldots\ldots + p_k .x_k$$

$$E(X) = \sum_{j=1}^{k} p_j.x_j$$

$$E(3X+5) = \sum_{j=1}^{k} p_j.(3x_j + 5)$$

$$\mu = E(X^2) = p_1.x_1^{\,2} + \ldots\ldots + p_k .x_k^{\,2}$$

$$E(X^2) = \sum_{j=1}^{k} p_j.x_j^{\,2}$$

# Expected number of the sum of score

$$E(X) = \frac{1}{36}\times 2 + \frac{2}{36}\times 3 + \ldots\ldots\ldots + \frac{1}{36}\times 12$$

$$E(X^2) = \frac{1}{36}\times 2^2 + \frac{2}{36}\times 3^2 + \ldots\ldots\ldots + \frac{1}{36}\times 12^2$$

$$E(X^2) = \frac{1}{36}\times 2^2 + \frac{2}{36}\times 3^2 + \ldots\ldots\ldots + \frac{1}{36}\times 12^2$$

# Some Results of E ( X )

**a and b are constant.**

* $E(a) = a$
* $E(aX) = aE(X)$
* $E(aX + b) = aE(X) + b$
* $E[f(x) \pm g(x)] = E[f(x)] \pm E[g(x)]$

$e.g\,,\ E(3X + 5) = 3E(X) + 5$

**Expected number of getting 7 in 300 times .**

**Expected number of getting 7 in 300 times**

$$= \frac{6}{36} \times 300 \quad = 50$$

# Variance

$$Var(X) = E\left(X - \overline{X}\right)^2$$

$$Var(X) = E(x^2) - \{E(x)\}^2$$

$$Note\_\ E(x^2) \geq \{E(x)\}^2$$

# Standard deviation

$$\sigma = \sqrt{Var(x)} \qquad Var(x) = \sigma^2$$

$$\sigma = \sqrt{E(x^2) - [E(x)]^2}$$

# Variance

$$Var(X) = E(x^2) - \{E(x)\}^2$$

$$Note\_\ E(x^2) \geq \{E(x)\}^2$$

# Standard deviation

$$\sigma = \sqrt{Var(x)} \qquad Var(x) = \sigma^2$$

$$\sigma = \sqrt{E(x^2) - [E(x)]^2}$$

# Some Results of Var ( X )

**a and b are constant.**

$$* \quad Var(a) = 0$$

$$* \quad Var(aX) = a^2 \, Var(X)$$

$$* \quad Var(aX + b) = a^2 \, Var(X)$$

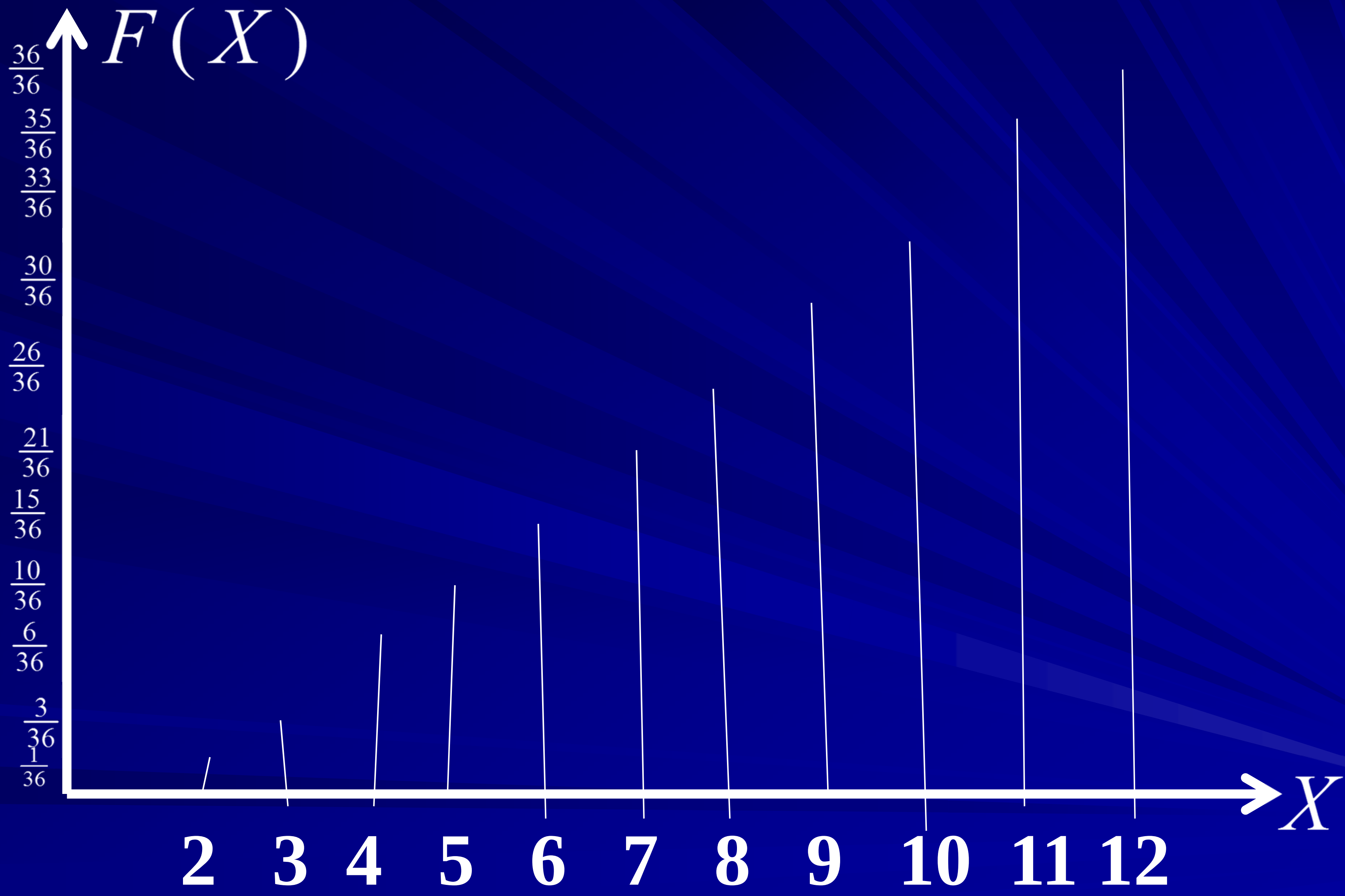
$$* \quad Var\left[f(x) \pm g(x)\right] = Var\left[f(x)\right] \pm Var\left[g(x)\right]$$

$$e.g \, , \quad Var(3X + 5) = 9 \, Var(X)$$

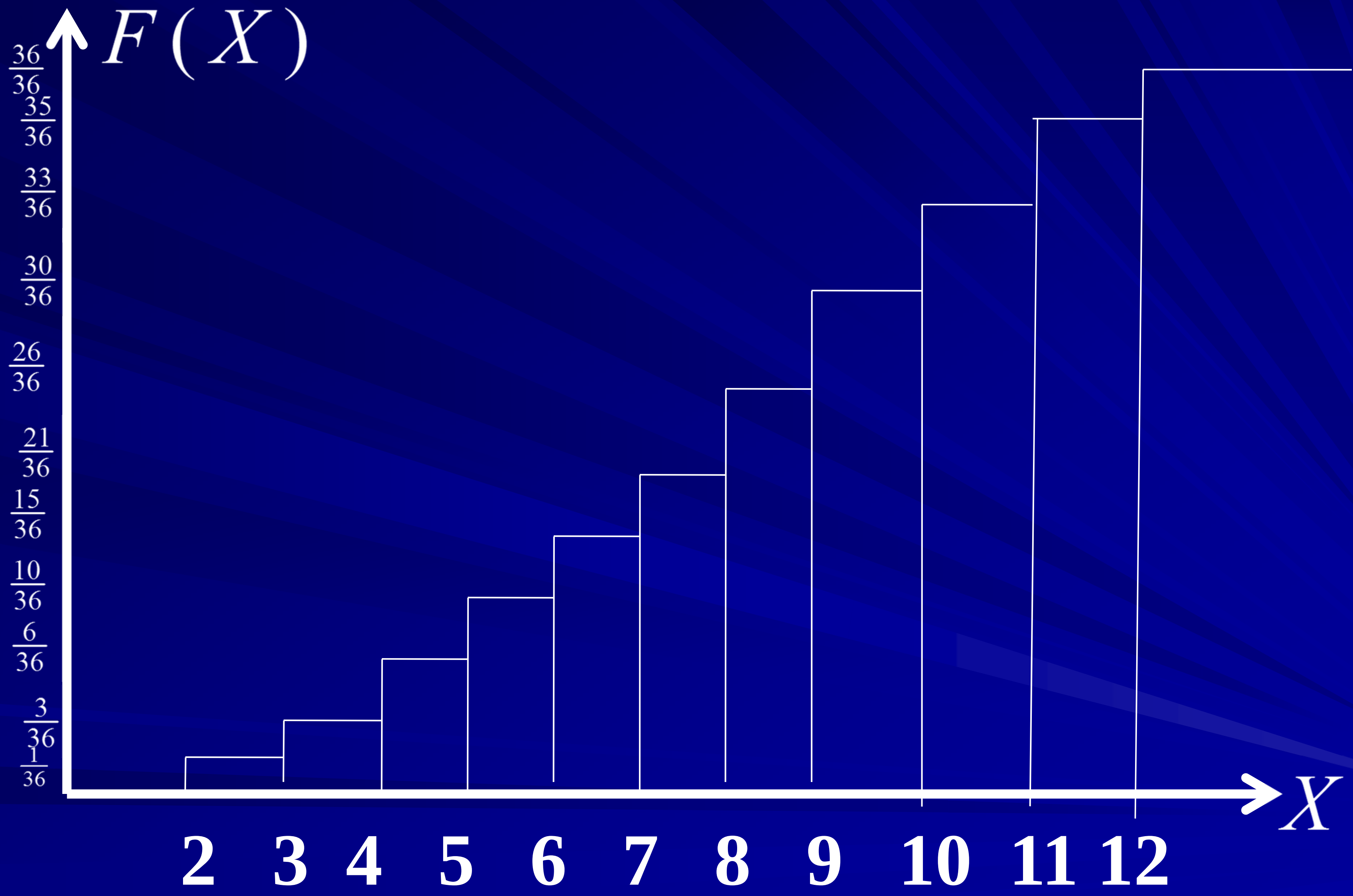
# Cumulative Probability, F ( X )

| X | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| P(X) | $\frac{1}{36}$ | $\frac{2}{36}$ | $\frac{3}{36}$ | $\frac{4}{36}$ | $\frac{5}{36}$ | $\frac{6}{36}$ | $\frac{5}{36}$ | $\frac{4}{36}$ | $\frac{3}{36}$ | $\frac{2}{36}$ | $\frac{1}{36}$ |
| F ( X ) | $\frac{1}{36}$ | $\frac{3}{36}$ | $\frac{6}{36}$ | $\frac{10}{36}$ | $\frac{15}{36}$ | $\frac{21}{36}$ | $\frac{26}{36}$ | $\frac{30}{36}$ | $\frac{33}{36}$ | $\frac{35}{36}$ | $\frac{36}{36}$ |

# Cumulative Graph



# Cumulative Graph



## Median

**The median splits the area under the curve y = f ( x ) into two halves. So if the value of the median is m ,**

$$P(a \le x \le m) \;=\; F(x) \;=\frac{1}{2}=0.5$$

$$\text{i.e },\quad F\,(\,m\,) = \frac{1}{2}$$

## Pg 107 . EX ( 1 ) No. 1

**If X is the random variable showing the number of boy in families with three children construct a table showing the probability distribution of X.**

**Pg 107 . EX ( 1 ) No. 1**

**X be the numbers of boys in family with three children**

$$R_x = \{0,1,2,3\} \qquad P(b) = \tfrac{1}{2}$$

$$P(g,g,g) = \frac{1}{2}\times\frac{1}{2}\times\frac{1}{2} = \frac{1}{8}$$

$$P(g,g,b) = \frac{1}{2}\times\frac{1}{2}\times\frac{1}{2} = \frac{1}{8}$$

$$P(g,b,g) = \frac{1}{2}\times\frac{1}{2}\times\frac{1}{2} = \frac{1}{8}$$

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$$P(b,b,b) = \frac{1}{2}\times\frac{1}{2}\times\frac{1}{2} = \frac{1}{8}$$

$$P(x=0)=\frac{1}{8}$$

$$P(x=1)=\frac{1}{8}+\frac{1}{8}+\frac{1}{8}=\frac{3}{8}$$

$$P(x=2)=\frac{1}{8}+\frac{1}{8}+\frac{1}{8}=\frac{3}{8}$$

$$P(x=3)=\frac{1}{8}$$

$$P_0 = P(x=0) = {}^3C_0 \left(\frac{1}{2}\right)^0 \left(\frac{1}{2}\right)^3 = \frac{1}{8}$$

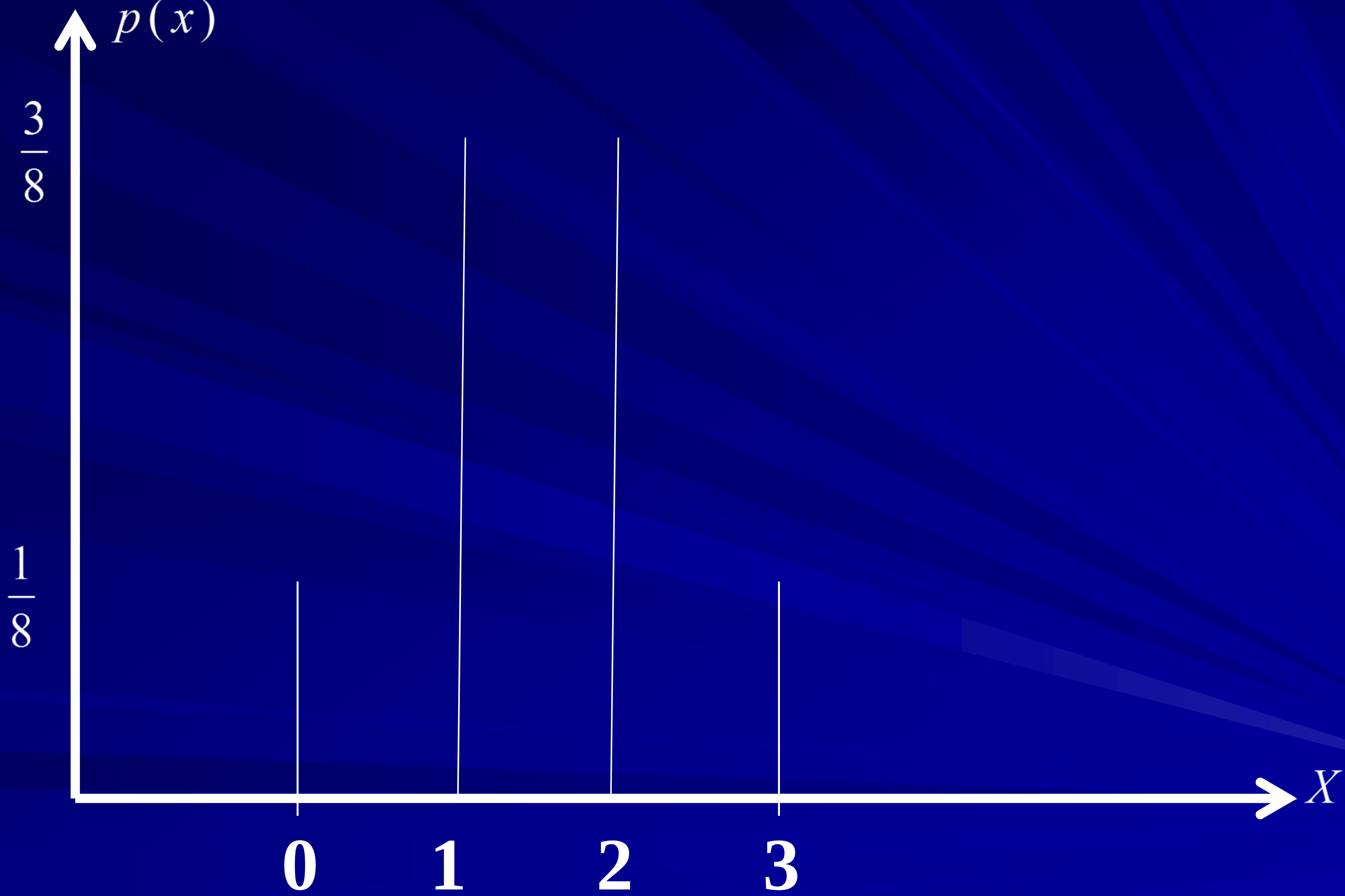
$$P_1 = P(x=1) = {}^3C_1 \left(\frac{1}{2}\right)^1 \left(\frac{1}{2}\right)^2 = \frac{3}{8}$$

$$P_2 = P(x=2) = {}^3C_2 \left(\frac{1}{2}\right)^2 \left(\frac{1}{2}\right)^1 = \frac{3}{8}$$

$$P_3 = P(x=3) = {}^3C_3 \left(\frac{1}{2}\right)^3 \left(\frac{1}{2}\right)^0 = \frac{1}{8}$$

| X | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| P(X) | $\frac{1}{8}$ | $\frac{3}{8}$ | $\frac{3}{8}$ | $\frac{1}{8}$ |
| F ( X ) | $\frac{1}{8}$ | $\frac{4}{8}$ | $\frac{7}{8}$ | $\frac{8}{8}$ |

# Probability Graph



**The expected number of boy**

$$E(X) = \frac{1}{8}\times 0 + \frac{3}{8}\times 1 + \frac{3}{8}\times 2 + \frac{1}{8}\times 3 = \frac{12}{8} = \frac{3}{2}$$

$$E(X^2) = \frac{1}{8}\times 0^2 + \frac{3}{8}\times 1^2 + \frac{3}{8}\times 2^2 + \frac{1}{8}\times 3^2 = \frac{24}{8} = 3$$

$$Var(X) = E(X^2) - \left[E(X)\right]^2$$

$$= 3 - \left[\tfrac{3}{2}\right]^2 = 3 - \frac{9}{4} = \frac{3}{4}$$

$$S\tan dard\ deviation, \sigma = \sqrt{Var(X)} = \frac{\sqrt{3}}{2}$$

**Pg 107 . EX ( 1 ) No. 3**

**Three marbles are draw without replacement from an urn containing 4 red and 6 white marbles. If X is a random variable which denotes the total number of red marbles drawn,**

**X be the number of red**

$R_x = \{0,1,2,3\}$ $W = White\ marble$ $R = \mathrm{Re}d\ marble$

$P(W,W,W) = \frac{6}{10}\times\frac{5}{9}\times\frac{4}{8} = \frac{5}{30}$ $P(R,W,W) = \frac{4}{10}\times\frac{6}{9}\times\frac{5}{8} = \frac{5}{30}$

$P(W,W,R) = \frac{6}{10}\times\frac{5}{9}\times\frac{4}{8} = \frac{5}{30}$ $P(R,W,R) = \frac{4}{10}\times\frac{6}{9}\times\frac{3}{8} = \frac{3}{30}$

$P(W,R,W) = \frac{6}{10}\times\frac{4}{9}\times\frac{5}{8} = \frac{5}{30}$ $P(R,R,W) = \frac{4}{10}\times\frac{3}{9}\times\frac{6}{8} = \frac{3}{30}$

$P(W,R,R) = \frac{6}{10}\times\frac{4}{9}\times\frac{3}{8} = \frac{3}{30}$ $P(R,R,R) = \frac{4}{10}\times\frac{3}{9}\times\frac{2}{8} = \frac{1}{30}$

$$P_0 = P(x=0) = \frac{5}{30}$$

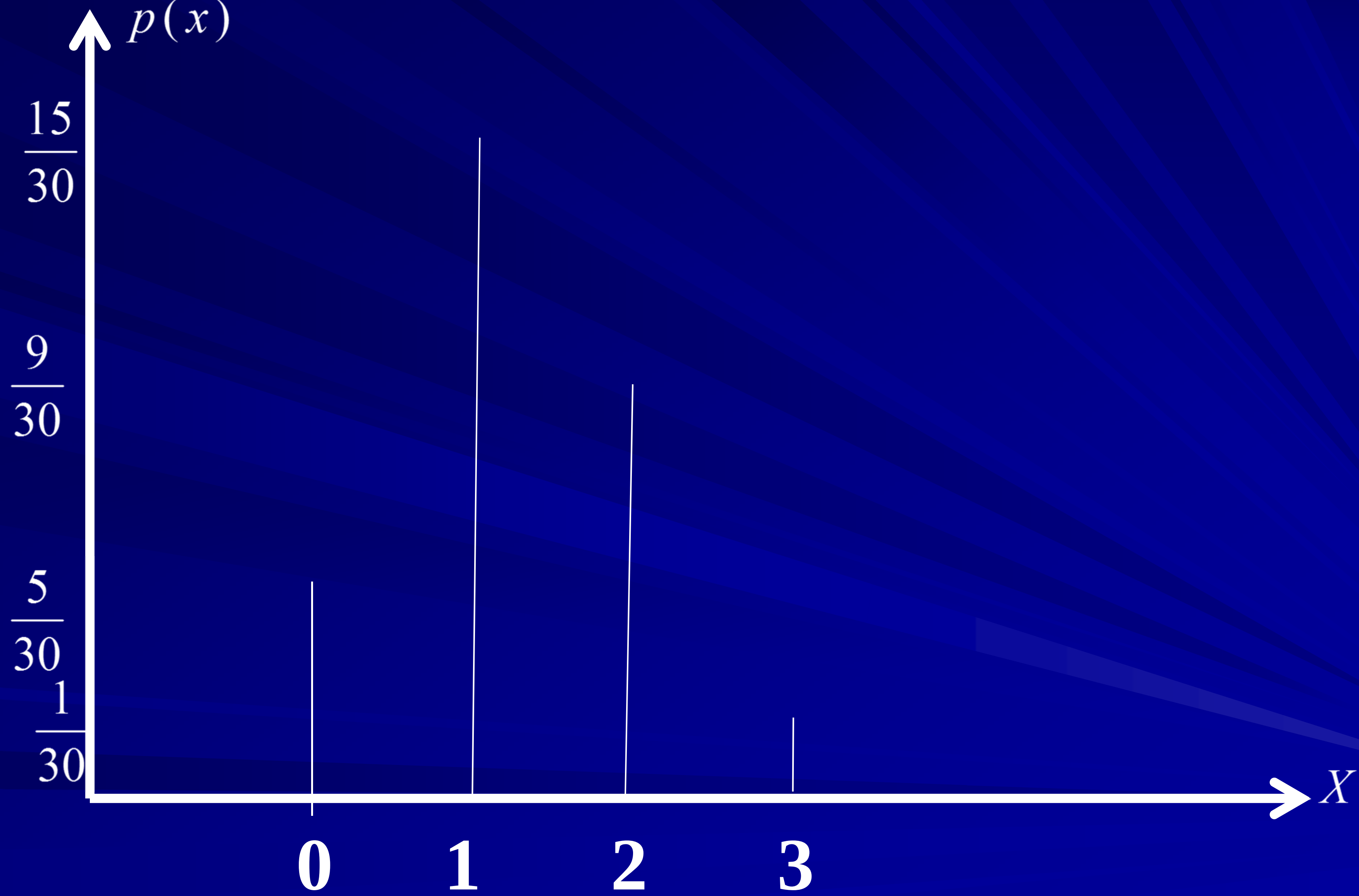
$$P_1 = P(x=1) = \frac{5}{30} + \frac{5}{30} + \frac{5}{30} = \frac{15}{30}$$

$$P_2 = P(x=2) = \frac{3}{30} + \frac{3}{30} + \frac{3}{30} = \frac{9}{30}$$

$$P_3 = P(x=3) = \frac{1}{30}$$

| X | 0 | 1 | 2 | 3 |
| --- | --- | --- | --- | --- |
| P(X) | $\frac{5}{30}$ | $\frac{15}{30}$ | $\frac{9}{30}$ | $\frac{1}{30}$ |
| F ( X ) | $\frac{5}{30}$ | $\frac{20}{30}$ | $\frac{29}{30}$ | $\frac{30}{30}$ |

# Probability Graph



## The expected number of red marbles

$$E(X) = \frac{5}{30} \times 0 + \frac{15}{30} \times 1 + \frac{9}{30} \times 2 + \frac{1}{30} \times 3 = \frac{36}{30} = \frac{6}{5}$$

$$E(X^2) = \frac{5}{30} \times 0^2 + \frac{15}{30} \times 1^2 + \frac{9}{30} \times 2^2 + \frac{1}{30} \times 3^2 = \frac{60}{30} = 2$$

$$Var(X) = E(X^2) - [E(X)]^2$$

$$= 2 - \left[\frac{6}{5}\right]^2 = 2 - \frac{36}{25} = \frac{14}{25}$$

$$S\tan dard\ deviation, \sigma = \sqrt{Var(X)} = \frac{\sqrt{14}}{5}$$

## Pg 110 . EX ( 2 ) No. 1

**If a man purchases a raffle ticket, he can win a first prize 0f \$ 5000 0r a second prize 0f \$ 2000 with probability 0.001 and 0.003. What should be a fair price to pay for the ticket?**

**Fair price to pay for the ticket**

$$= (0.001)\times(5000) + (0.003)\times(2000) = 11\$$$

## Pg 110 . EX ( 2 ) No. 2

**In a given business venture a man can make a profit of \$ 300 with probability 0.6 or take a loss 0f \$ 100 with probability 0.4. Determine his expectation.**

**Expectation of this man**

$$= (0.6)\times(300) + (0.4)\times(-100) = 140\$$$

## Pg 110 . EX ( 2 ) No. 4

**A gag contains two white balls and three back balls. Four persons A , B , C , D in order named each draws one balls and does not replaced. The first to draw a white ball receives $ 10. Determine their expectations.**

$$E(A) = ?$$

$$E(B) = ?$$

$$E(C) = ?$$

$$E(D) = ?$$

## Pg 108 . EX ( 1 ) No. 5

**A draw contains 8 brown socks and 4 blue socks. A sock is taken from the drawer at random its colour is note and it is then replaced. This procedure is performed twice more. If X is the random variable "the number of brown socks taken", find the probability distribution of X.**

**X is the random variable "the number of brown socks taken"**

**N be the nomber draw. N >2**

$$R_X = \{0,1,2,3,........., N\}$$

$$P_0 = P(x=0) = {}^{N}C_0 \left(\frac{2}{3}\right)^0 \left(\frac{1}{3}\right)^N = \left(\frac{1}{3}\right)^N$$

$$P_1 = P(x=1) = {}^{N}C_1 \left(\frac{2}{3}\right)^1 \left(\frac{1}{3}\right)^{N-1} = N\left(\frac{2}{3}\right)\left(\frac{1}{3}\right)^{N-1}$$

$$P_N = P(x=N) = {}^{N}C_N \left(\frac{2}{3}\right)^N \left(\frac{1}{3}\right)^0 = \left(\frac{2}{3}\right)^N$$

| X | 0 | 1 | - | - | - | N |
|---|---|---|---|---|---|---|
| P(X) | ${}^{N}C_{0}(\frac{1}{3})^{N}$ | ${}^{N}C_{1}(\frac{2}{3})(\frac{1}{3})^{N-1}$ | | | | ${}^{N}C_{N}(\frac{2}{3})^{N}$ |

# Binomial Distribution

N = number of trials

p = probability of success in any single trial of N trials.

$q = 1 - P$ = probability of failure in any single trial of N trials.

X = number of success in N trials.

$N - X$ = number of failure in N trials.

$$P(X=x) = {}^{N}C_x \ p^x \ q^{N-x} \qquad , where\ X = 0,1,2,\ldots\ldots N$$

**This discrete probability distribution is often called the binomial distribution since for X = 0 , 1 , 2 , ….. , N it corresponds to successive terms in the binomial expansion**

$$(p+q)^N = {}^{N}C_0 \ p^0 \ q^{N-0} + {}^{N}C_1 \ p^1 \ q^{N-1} + \ldots\ldots + {}^{N}C_N \ p^N \ q^{N-N}$$

# Some Properties Binomial Distribution

$$\mu = E(X) = Np$$

$$Var(X) = Npq$$

$$Standard\ deviation,\ \sigma = \sqrt{Var(X)} = \sqrt{Npq}$$

$$E(N - X) = Nq$$

$$Var(N - X) = Npq$$

Pg 122 , No.10

**An ordinary die is thrown seven times. Find the probability of ( i )obtaining exactly three six. ( ii )obtain at most three six (iii) obtain exactly three not six( iv ) obtain more than five time not six (v) expectation of getting six (vi) standard deviation**

**N = the numbers of thrown the die**

**p = the probability of getting six in any single thrown**

**q = the probability of not getting six in any single thrown**

**X = the numbers of times of getting six in N trial**

**N–X =the numbers of times of not getting six in N trial**

$$N = 7 \qquad p = \frac{1}{6} \qquad q = \frac{5}{6}$$

$N = 7 \qquad p = \frac{1}{6} \qquad q = \frac{5}{6}$

**( i ) obtain exactly three six**

$X = 3 \quad , \quad N - X = 4$

$$P(X = x) = {}^{N}C_{x}\ p^{x}\ q^{N-x}$$

$$P(X = 3) = {}^{7}C_{3}\ p^{3}\ q^{4} = {}^{7}C_{3}\ (\frac{1}{6})^{3}\ (\frac{5}{6})^{4}$$

$$= \frac{7 \times 6 \times 5}{3 \times 2 \times 1}\ (\frac{1}{6})^{3}\ (\frac{5}{6})^{4}$$

$$= 35\ (\frac{1}{6})^{3}\ (\frac{5}{6})^{4}$$

( ii ) obtain at most three six

$$X \leq 3$$

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

$$= {}^7C_0\ p^0\ q^7\ +{}^7C_1\ p^1\ q^6\ +{}^7C_2\ p^2\ q^5\ +{}^7C_3\ p^3\ q^4$$

$$= 1\times(\frac{1}{6})^0\ (\frac{5}{6})^7\ +7\times(\frac{1}{6})^1\ (\frac{5}{6})^6 + \frac{7\times 6}{2\times 1}\times(\frac{1}{6})^2\ (\frac{5}{6})^5$$

$$+\frac{7\times 6\times 5}{3\times 2\times 1}\times(\frac{1}{6})^2\ (\frac{5}{6})^5$$

$$= (\frac{5}{6})^7\ +7\times(\frac{1}{6})\ (\frac{5}{6})^6 + 21\times(\frac{1}{6})^2\ (\frac{5}{6})^5 + 35\times(\frac{1}{6})^2\ (\frac{5}{6})^5$$

**( iii ) obtain exactly three not 6**

$$N - X = 3$$

$$7 - X = 3$$

$$X = 4$$

$$P(N - X = 3) = P(X = 4) = {}^{7}C_{4}\ p^{4}\ q^{3} = {}^{7}C_{4}\ \left(\frac{1}{6}\right)^{4} \left(\frac{5}{6}\right)^{3}$$

$$= \frac{7\times6\times5}{3\times2\times1}\left(\frac{1}{6}\right)^{4}\left(\frac{5}{6}\right)^{3}$$

$$= 35\left(\frac{1}{6}\right)^{4}\left(\frac{5}{6}\right)^{3}$$

## ( iv ) obtain more than five time not six

$$N - X > 5$$

$$7 - X > 5$$

$$X < 2$$

$$P(N - X > 5) = P(X < 2) = P(X=0) + P(X=1)$$

$$= {}^7C_0 \; p^0 \; q^7 + {}^7C_1 \; p^1 \; q^6$$

$$= 1 \times \left(\frac{1}{6}\right)^0 \left(\frac{5}{6}\right)^7 + 7 \times \left(\frac{1}{6}\right)^1 \left(\frac{5}{6}\right)^6$$

$$= \left(\frac{5}{6}\right)^7 + 7 \times \left(\frac{1}{6}\right) \left(\frac{5}{6}\right)^6$$

**( v ) expectation of getting six**

$$\mu = E(X) = Np$$

$$\mu = E(X) = 7 \times \frac{1}{6}$$

(vi) Standard deviation, $\sigma = \sqrt{Var(X)} = \sqrt{Npq}$

$$\sigma = \sqrt{7 \times \frac{1}{6} \times \frac{5}{6}}$$

$$\sigma = \frac{\sqrt{35}}{6}$$

**The probability that a pen drawn at random from a box of pens is defective is 0.1. If a sample of 6 pens is taken, find the probability that ( i ) no defective pen ( ii ) 5 or 6 defective pens ( iii ) less than 3 defective pen (iv) expectation of defective ( v ) expectative of non defective (vi) variance**

**N = the numbers of pens**

**p = the probability of getting defective pen in any single pen.**

**q = the probability of getting non defective pen in any single pen.**

**X = the no. of getting defective pen in 6 pen.**

**N – X = the no. of getting non defective pen in 6 pen.**

$N = 6 \qquad p = 0.1 \qquad q = 0.9$

**(i) X = 0 , N – X = 6**

$$P(X = x) = {}^{N}C_{x}\ p^{x}\ q^{N-x}$$

$$P(X = 0) = {}^{6}C_{0}\ p^{0}\ q^{6} = 1 \times (0.1)^{0}\ (0.9)^{6}$$

$$= (0.9)^{6}$$

# ( ii ) X = 5 or 6

$$P(X = 5 \text{ or } 6) = P(X=5)+P(X=6)$$

$$= {}^6C_5\ p^5\ q^1 \quad + {}^6C_6\ p^6\ q^0$$

$$= {}^6C_1\ p^5\ q^1 \quad + {}^6C_0\ p^6\ q^0$$

$$= 6\times (0.1)^6\ (0.9)^1 \quad + 1\times (0.1)^6\ (0.9)^0$$

$$= 6\times (0.1)^6\ (0.9)\ + (0.1)^6$$

( iii ) $X < 3$

$$P(X < 3) = P(X = 0) + P(X=1) + P(X=2)$$

$$= {}^6C_0\ p^0\ q^6 \quad + {}^6C_1\ p^1\ q^5 \quad + {}^6C_2\ p^2\ q^4$$

$$= 1 \times (0.1)^0\ (0.9)^6 + 6 \times (0.1)^1\ (0.9)^5 + \frac{6 \times 5}{2 \times 1} \times (0.1)^2\ (0.9)^4$$

$$= (0.9)^6 \quad + 6 \times (0.1)\ (0.9)^5 \qquad + 15 \times (0.1)^2\ (0.9)^4$$

$$\mu = E(X) = Np$$

$$\mu = E(\text{defective}) = 6 \times 0.1 = 0.6$$

$$\mu = E(\text{non defective}) = 6 \times 0.9 = 5.4$$

$$\begin{aligned} \text{Variance} &= Npq \\ &= 6 \times (0.1)(0.9) \\ &= 0.54 \end{aligned}$$

**The probability that a person serves a company A is 0.6. Find the probability that in a randomly selected sample of 8 lavourers there are ( i ) exactly 3 who serve company A. ( ii ) more than 5 who serve copany A. ( iii )less than 2 who does not serve copany A (iv)expectation of serve copany A (v)standard deviation**

**N = the numbers of labourers**

**p = the probability of serve copany A in any single person**

**q = the probability of not serve copany A in any single person**

**X = the numbers of person who serve copany A in N labourers**

**N – X = the numbers of person who do not serve copany A in N lavourers**

$N = 8$ $p = 0.6$ $q = 0.4$

**( i ) exactly 3 person who serve copany A**

**X = 3 , N – X = 5**

$$P(X = x) = {}^{N}C_{x}\ p^{x}\ q^{N-x}$$

$$P(X = 3) = {}^{8}C_{3}\ p^{3}\ q^{5} = {}^{8}C_{3}\ (0.6)^{3}\ (0.4)^{5}$$

$$= \frac{8\times 7\times 6}{3\times 2\times 1}(0.6)^{3}\ (0.4)^{5}$$

$$= 56\ (0.6)^{3}\ (0.4)^{5}$$

**( ii ) more than 5 who serve copany A**

$$X > 5$$

$$P(X > 5) = P(X=6) + P(X=7) + P(X=8)$$

$$= {}^8C_6 \; p^6 \; q^2 \quad + {}^8C_7 \; p^7 \; q^1 \quad + {}^8C_8 \; p^8 \; q^0$$

$$= {}^8C_2 \; p^6 \; q^2 \quad + {}^8C_1 \; p^7 \; q^1 \quad + {}^8C_0 \; p^8 \; q^0$$

$$= \frac{8 \times 7}{2 \times 1} \times (0.6)^6 \; (0.4)^2 \; + 8 \times (0.6)^7 \; (0.4)^1 \; + 1 \times (0.6)^8 \; (0.4)^0$$

$$= 28 \times (0.6)^6 \; (0.4)^2 \quad + 8 \times (0.6)^7 \; (0.4) \quad + (0.6)^8$$

**( iii ) less than 2 who does not serve copany A**

$$N - X < 2$$

$$8 - X < 2$$

$$X > 6$$

$$P(N - X < 2) = P(X > 6) = P(X = 7) + P(X = 8)$$

$$= {}^{8}C_{7}\, p^{7}\, q^{1} + {}^{8}C_{8}\, p^{8}\, q^{0}$$

$$= {}^{8}C_{1}\, p^{7}\, q^{1} + {}^{8}C_{0}\, p^{8}\, q^{0}$$

$$= 8\,(0.6)^{7}\,(0.4)^{1} + 1 \times (0.6)^{8}\,(0.4)^{0}$$

$$= 8\,(0.6)^{7}\,(0.4) + (0.6)^{8}$$

**( iv ) expectation of serve copany A**

$$\mu = E(X) = Np$$

$$\mu = E(X) = 8\times 0.6 = 4.8$$

$$\text{Standard deviation, } \sigma = \sqrt{Var(X)} = \sqrt{Npq}$$

$$\sigma = \sqrt{8\times 0.6\times 0.4}$$

**Pg 122 , No.14**

**In a group of people the expected number who wear glasses is 2 and the variance is 1.6. Find the probability that ( i ) a person chosen at random from the group wear glasses, ( ii ) 6 people in a group wear glasses.**

**N = the numbers of people in a group**

**p = the probability of wear glasses in single person**

**q = the probability of not wear glasses in single person**

**X = the no. of persons who wear glasses in a group**

**N–X =the no. of person who does not wear glasses in a group**

$N = N \quad p = p \quad q = q \quad E(X) = Np = 2 \quad \sigma = Npq = 1.6$

$$E(X) = Np = 2$$

$$Np = 2 \quad \rule{3cm}{0.4pt} \quad (1)$$

$$Var(X) = Npq = 1.6$$

$$Npq = 1.6 \quad \rule{3cm}{0.4pt} \quad (2)$$

$$eq(2) \div eq(1) \Rightarrow \frac{Npq}{Np} = 0.8$$

$$q = 0.8$$

$$p + q = 1$$

$$p + 0.8 = 1$$

$$p = 0.2$$

**The probability that a person chosen at random from the group wear glasses is 0.2**

## (ii) $X = 6$

$$P(X = 6) = {}^{10}C_6 \; p^6 \; q^4$$

$$= \frac{10 \times 9 \times 8 \times 7 \times 5 \times 4}{6 \times 5 \times 4 \times 3 \times 2 \times 1} \times (0.2)^6 \; (0.8)^4$$

$$= 210 \times (0.2)^6 \; (0.8)^4$$

**( iii ) N – X = 3**

**7 – X = 3**

**X = 4**

$$P(N - X = 3) = P(X = 4) = {}^{7}C_4\, p^4\, q^3 = {}^{7}C_4\, (\frac{1}{6})^4\, (\frac{5}{6})^3$$

$$= \frac{7\times6\times5}{3\times2\times1}\, (\frac{1}{6})^4\, (\frac{5}{6})^3$$

$$= 35\, (\frac{1}{6})^4\, (\frac{5}{6})^3$$

**A box contain a large number of red and blue tulip bulbs in the ratio 1 : 4 . Bulbs are picked N times with replacement at random from the box,**

**( i ) If N = 10, then find the probability that for getting four red bulbs. ( ii ) If expected numbers of red is 4, then find the probability that for getting five red bulbs. ( iii ) If standard deviation is 2, then find the probability that for getting four or five blue bulbs.**

**N = the numbers of draws**

**p = the probability of getting red in any single draw**

**q = the probability of getting blue in any single draw**

**X = the no. of red bulbs in N draws**

**N–X = the no. of blue bulbs in N draws**

$$\mathrm{N} = \mathrm{N} \qquad p = \frac{1}{5} \qquad q = \frac{4}{5}$$

**A box contain a large number of red and blue tulip bulbs in the ratio 1 : 4 . Bulbs are picked N times with replacement at random from the box, if the probability that no blue bulb is $6.4 \times 10^{-5}$ .Find the probability that ( i ) for getting at most two red bulbs ( ii ) less than two blue bulbs.**

Pg 120 , No.3

In a multiple choice test there are 10 questions and for each question there is a choice of 4 answers, only one of which is correct. If a student guesses at each of the answers, find the probability that he gers ( a ) no correct ( b ) more than 7 correct ( c ) more than 2 correct.

N = the numbers of questions

p = the probability of correct in any single question

q = the probability of uncorrer in any single question

X = the no. of correcr answers in N questions.

N–X =the no. of uncorrect answers in N questions

$N = 10 \qquad p = \frac{1}{4} \qquad q = \frac{3}{4}$

$N = 10 \qquad p = \frac{1}{4} \qquad q = \frac{3}{4}$

**( i ) no correct**

$$P(X = 0) = {}^{10}C_0 \; p^0 \; q^{10} = \left(\frac{3}{4}\right)^{10}$$

**( ii ) more than 7 correct**

$$P(X > 7) = P(X=8)+P(X=9)+P(X=10)$$

$$= {}^{10}C_8 \; p^8 \; q^2 + {}^{10}C_9 \, p^9 \, q + {}^{10}C_{10} \, p^{10} \; q^0$$

$$= 45\left(\frac{1}{4}\right)^8 \left(\frac{3}{4}\right)^2 + 10\left(\frac{1}{4}\right)^9 \left(\frac{3}{4}\right) + \left(\frac{1}{4}\right)^{10}$$

**( iii ) more than 2 correct**

$$P(X > 2) = 1 - \{P(X \le 2\} = 1 - \{P(X=0)+P(X=1)+P(X=2)\}$$

$$= 1 - \{ {}^{10}C_0 \; p^0 \; q^{10} + {}^{10}C_1 \, p^1 \, q^9 + {}^{10}C_2 \, p^2 \; q^8 \}$$

$$= 1 - \{ \left(\frac{3}{4}\right)^{10} + 10\left(\frac{1}{4}\right)\left(\frac{3}{4}\right)^9 + 45 \left(\frac{1}{4}\right)^2 \left(\frac{3}{4}\right)^8 \}$$

**If the probability that it is the fine day is 0.4, find the expected number of fine days in a week, and the standard deviation. Find the expected number of bad days in a week.**

**N = the numbers of day in a week**

**p = the probability of fine day in single day**

**q = the probability of bad day in single day**

**X = the numbers of fine days in a week**

**N–X = the numbers of bad days in a week**

$N = 7$ $p = 0.4$ $q = 0.6$

$$E(X) = Np = 7 \times 0.4 = 2.8$$

$$\text{Standard deviation, } \sigma = \sqrt{Var(X)} = \sqrt{Npq}$$

$$\sigma = \sqrt{7 \times 0.4 \times 0.6}$$

$$E(N - X) = Nq = 7 \times 0.6 = 4.2$$

**The probability that an apple, picked at random from a sack, is bad is 0.05. Find the standard deviation of the number of bad apples in a sample of 15 apples. Find the expected number of bad apple**

**N = the numbers of sample apples**

**p = the probability of bad apple in single apple**

**q = the probability of good apple in single apple**

**X = the numbers of bad apples in 15 apples**

**N–X =the numbers of good apples in 15 apples**

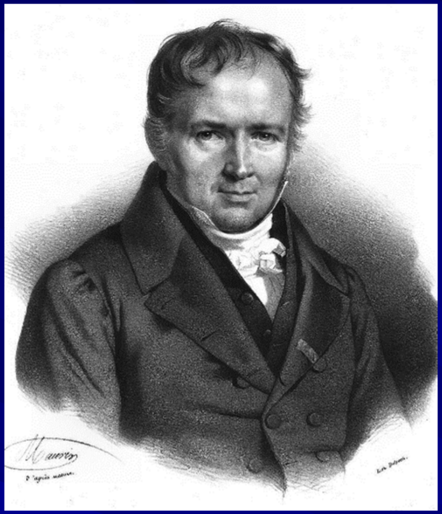
$N = 15$ $p = 0.05$ $q = 0.95$

$$\text{Standard deviation}, \ \sigma = \sqrt{Var(X)} = \sqrt{Npq}$$

$$\sigma = \sqrt{15 \times 0.05 \times 0.95}$$

$$\mu = E(X) = Np = 15 \times 0.05 = 0.75$$

# Poison Distribution



# Poison Distribution

When n is larg and p is small in a binomial distribution.

If x is the numbers of occurrences of random event in an interval of time or space or some volume of matter. The random variavle x has a Poisson distribution if and only if the probability distribution is given by

$$P(x) = \frac{e^{-\lambda} \lambda^{x}}{x!} \quad , x = 0,1,2,\ldots\ldots$$

$When \ \lambda = n p$

$$P(x = k) = \frac{e^{-\lambda} \lambda^{k}}{k!} \quad , k = 0,1,2,\ldots\ldots$$

## Poison Distribution

Examples of events which might follow a poisson distribution distribution:

The number of

( i ) flaws in a given length of material

( ii ) car accidents on a particular stretch of road in one day

( iii ) accidents in a factory in one week

( iv ) telephone calls made to a switchboard in a given time

( v ) insurance claim made to a company in a given time

( vi ) particles emitted by a radioactive source in a given time

## A time interval

$$P(x=k)=\frac{e^{-\lambda t}(\lambda t)^k}{k!} \qquad ,k=0,1,2,\ldots\ldots$$

## A given length

$$P(x=k)=\frac{e^{-\lambda l}(\lambda l)^k}{k!} \qquad ,k=0,1,2,\ldots\ldots$$

## A given region

$$P(x=k)=\frac{e^{-\lambda a}(\lambda a)^k}{k!} \qquad ,k=0,1,2,\ldots\ldots$$

## A given volume

$$P(x=k)=\frac{e^{-\lambda v}(\lambda v)^k}{k!} \qquad ,k=0,1,2,\ldots\ldots$$

## Using the Poison Distribution as an approximation to the Binomial Distribution

A binomial distribution with parameter n and p can be approximated by a poisson distribution, with parameter $\lambda = np$, if n is large ( > 50 say ) and p is small ( < 0.1 say ). The approximation get better as $n \rightarrow \infty$ and $p \rightarrow 0$.

$$( p + q )^n \rightarrow e^{-\lambda} \left( 1 + \lambda + \frac{\lambda^2}{2!} + \ldots\ldots\ldots \right)$$

$$When \;\; \lambda = n\, p$$

$$P( x = k ) = \frac{e^{-\lambda} \; \lambda^k}{k!} \quad , k = 0, 1, 2, \ldots\ldots$$

Find the probability that at least double sixes are obtained when two dice are thrown 90 times. ( $e^{-2.5} = 0.082$ )

Throw two dice, P ( double sixes ) $= \frac{1}{6} \times \frac{1}{6} = \frac{1}{36}$

$$X \sim Bin(90, \frac{1}{36}) \text{ and } np = 90 \times \frac{1}{36} = 2.5 \quad , \quad X \sim Poi(2.5)$$

$$P(x = k) = \frac{e^{-2.5}(2.5)^k}{k!} \quad , k = 0, 1, 2, 3, 4, 5, \ldots.$$

$$P(x \geq 2) = 1 - \{P(x = 0) + P(x = 1)\}$$

$$= 1 - \left( \frac{e^{-2.5}(2.5)^0}{0!} + \frac{e^{-2.5}(2.5)^1}{1!} \right)$$

$$= 1 - e^{-2.5}(1 + 2.5) \quad = 1 - (0.082)(3.5) = 0.713$$

$$Var(X) = E(X^2) - [E(X)]^2$$

$$= \left(\lambda + \lambda^2\right) - \lambda^2$$

$$Var(X) = \lambda$$

## Mode of Poisson

In general, λ is not an integer, then mode is the integer

$$\lambda - 1 < \text{mod } e < \lambda$$

If the number of bacterial colonies on a pertri dish follows a Poisson distribution with average number 2.5 per cm$^2$, find the probability that ( a ) in 1 cm$^2$ there will be no bacterial colonies ( b ) in 1 cm$^2$ there will be more than 4 bacterial colonies ( c ) in 2 cm$^2$ there will be 4 bacterial colonies ( d ) in 4 cm$^2$ there will be 6 bacterial colonies. ( $e^{-2.5} = 0.082$ ) ( $e^{-5} = 0.0067$ ) ( $e^{-10} = 4.5$ _ $10^{-5}$ )

$$\lambda = 2.5 \; per \; cm^2$$

$$P(x = k) = \frac{e^{-\lambda} \lambda^k}{k!} \qquad , k = 0,1,2,3,4,5,....$$

x be the the number of bacterial colonies

$$(a) \; P(x = 0) = \frac{e^{-2.5} (2.5)^0}{0!} = 0.082$$

$$(a)\ P(x=0)=\frac{e^{-2.5}\,(2.5)^0}{0!}=0.082$$

$$(b)\ P(x>4)=1-\{P(x=0)+P(x=1)+P(x=2)+P(x=3)+P(x=4)\}$$

$$=1-\{\frac{e^{-2.5}\,(2.5)^0}{0!}+\frac{e^{-2.5}\,(2.5)^1}{1!}+\frac{e^{-2.5}\,(2.5)^2}{2!}+\frac{e^{-2.5}\,(2.5)^3}{3!}+\frac{e^{-2.5}\,(2.5)^4}{4!}\}$$

$$=1-e^{-2.5}\left\{1+2.5+\frac{(2.5)^2}{2}+\frac{(2.5)^3}{6}+\frac{(2.5)^4}{24}\right\}$$

$$(c)\ \mu=\lambda a=2.5\times 2=5$$

$$P(x=4)=\frac{e^{-5}\,(5)^4}{4!}=\frac{0.067\times 625}{4!}=1.745$$

$$(c)\ \ \mu = \lambda a = 2.5 \times 2 = 5$$

$$P(x = 4) = \frac{e^{-5}\ (5)^4}{4!} = \frac{0.067 \times 625}{4!} = 1.745$$

$$(c)\ \ \mu = \lambda a = 2.5 \times 4 = 10$$

$$P(x = 6) = \frac{e^{-10}\ (10)^6}{6!} = \frac{4.5 \times 10^{-5} \times 10^6}{6!} = 0.0139$$

The probability that any telephone subscriber call the swithboard during one hour is 0.1. The telephone station servrices 300 subscribers. What is the probability that 4 subscribers will call the swithboard durind one hour ?What is the probability that at least 3 call in one hour( $e^{-3} = 0.0498$ )

$$n = 300\ ,\ p = 0.1 \qquad \lambda = n\,p = 300 \times 0.1 = 3$$

$$P(x = k) = \frac{e^{-\lambda}\ \lambda^{k}}{k!} \qquad , k = 0,1,2,3,4,5$$

x be the the number of subscribers

$$P(x = 4) = \frac{e^{-\lambda} \times \lambda^{4}}{4!} = \frac{e^{-3} \times 3^{4}}{4!} = \frac{0.0498 \times 3^{4}}{4!}$$

$$= 1.681$$

at least 3 call

$$P(x \geq 3) = 1 - \{P(x=0) + P(x=1) + P(x=2)\}$$

$$= 1 - \left\{ \frac{e^{-3} \times 3^{0}}{0!} + \frac{e^{-3} \times 3^{1}}{1!} + \frac{e^{-3} \times 3^{2}}{2!} \right\}$$

$$= 1 - e^{-3} \{1 + 3 + 4.5\}$$

$$= 1 - (0.0498 \times 8.5)$$

$$= 0.5767$$

Suppose that the probability that a certain type of inoculation take effect is 0.995. What is the probability at most two out of 400 people given the inoculation, find that it has no taken effect ? ( $e^{-2} = 0.1315$ )

$$n = 400 \ ,$$

$$P(\textit{inoculation taken effect}) = 0.995$$

$$P(\textit{inoculation taken no effect}) = 0.005$$

$$\lambda = n \ p = 400 \times 0.005 = 2$$

$$P(x = k) = \frac{e^{-\lambda} \ \lambda^k}{k!} \qquad , k = 0,1,2,3,4,5$$

x be the the number of people among the 400 from who the inoculation does not effect

$$P(x \le 2) = \ P(x = 0) + P(x=1) + P(x=2)$$

$$P(x \le 2) = P(x=0) + P(x=1) + P(x=2)$$

$$= \frac{e^{-2} \times 2^0}{0!} + \frac{e^{-2} \times 2^1}{1!} + \frac{e^{-2} \times 2^2}{2!}$$

$$= e^{-2}\left[1 + 2 + 2\right]$$

$$= 0.1353 \times 5$$

$$= 0.6765$$

The expected number of people among the 1000 from who the inoculation does not effect $= 1000 \times 0.005 = 5$

An electric sing is contricted using 1000, 15 watt bulbs. The probability that a new 15 watt bulb will operate for ten hours is given to be 0.995. It all bulbs are new determine the probability that ( i ) the sing will operate the first ten hours without any bulbs buring out ( ii ) exactly x bulbs will burn out in the first ten hours ( iii ) at least two bulbs will burn out in the first ten hours. ( $e^{-5} = 0.0067$ )

Solution

x be the the number of bulbs burn out in first ten hours

P ( a new bulb will burn out in first ten hour ) = 1 – 0.995 = 0.005

$$\lambda = 1000 \times 0.005 = 5$$

$$P(x = k) = \frac{e^{-\lambda} \lambda^k}{k!} \qquad , k = 0,1,2,3,4,5$$

$$(i)\ P(x=0) = \frac{e^{-5} \times 5^{0}}{0!} = 0.0067$$

$$(ii)\ P(x=x) = \frac{e^{-5} \times 5^{x}}{x!}$$

$$(iii)\ P(x \geq 2) = 1 - \{P(x=0) + P(x=1)$$

$$= 1 - \left\{ \frac{e^{-5} \times 5^{0}}{0!} + \frac{e^{-5} \times 5^{1}}{1!} \right\}$$

$$= 1 - e^{-5}\{1+5\}$$

$$= 1 - 0.0067 \times 6$$

$$= 0.9598$$

In a certain region the number of persons who became seriously ill each year eating a certain poisonous plant is a random variable had being the Poission distribution with mean is 2. What is the probability of at most 3 such illnesses in a given year. ( $e^{-2} = 0.1315$ )

Solution

x be the the number of person who become seriously ill each year from eating a certain poisonuous plant

$$\lambda = 2$$

$$P(x = k) = \frac{e^{-\lambda}\ \lambda^{k}}{k!} \qquad , k = 0,1,2,3,4,5...$$

$$P(x \le 3) = P(x=0) + P(x=1) + P(x=2) + P(x=3)$$

$$P(x \le 3) = P(x=0) + P(x=1) + P(x=2) + P(x=3)$$

$$= \frac{e^{-2} \times 2^0}{0!} + \frac{e^{-2} \times 2^1}{1!} + \frac{e^{-2} \times 2^2}{2!} + \frac{e^{-2} \times 2^3}{3!}$$

$$= e^{-2} \left[ 1 + 2 + 2 + 1.33 \right]$$

$$= 0.1353 \times 6.33$$

$$= 0.8564$$

The probability that a car will have a flat tire while driving over a certain bridge is 0.0002. Find the probability that among 2000 cars driven over the bridge not more than one will have a flat tire. ( $e^{-0.4} = 0.67$ )

Solution

x be the the number of car which will have flat tire while driving over a certain bridge

$$n = 2000, \quad P(\text{ flat tire while driving over }) = 0.0002$$

$$\lambda = 2000 \times 0.0002 = 0.4$$

$$P(x = k) = \frac{e^{-\lambda} \lambda^k}{k!} \qquad , k = 0,1,2,3,4,5$$

$$P(x \le 1) = P(x = 0) + P(x = 1)$$

$$P(x \le 1) = P(x=0) + P(x=1)$$

$$= \frac{e^{-0.4} \times (0.4)^0}{0!} + \frac{e^{-0.4} \times (0.4)^1}{1!}$$

$$= e^{-0.4} \left[1 + 0.4\right]$$

$$= 0.67 \times 1.4$$

$$= 0.938$$

The evarage car will have a flat tire while driving over a certain bridge is 0.4 per day. Find the expected number of the day out of 100 days when there will be ( i ) no flat tire ( ii ) nor more than one flat tire ( iii ) between 2 and 5 flat tire. . ( $e^{-0.4} = 0.67$ )

Solution

x be the the number of car which will have flat tire

$$\lambda = 0.4$$

$$(i)\ P(x = 0) = \frac{e^{-0.4}\ (0.4)^k}{0!} = 0.67$$

The expect no. of day which no flat tire

$$= 0.67 \times 100 = 67\ days$$

$$(ii)\ P(x \le 1) = P(x=0) + P(x=1)$$

$$= \frac{e^{-0.4} \times (0.4)^0}{0!} + \frac{e^{-0.4} \times (0.4)^1}{1!}$$

$$= e^{-0.4} [1 + 0.4]$$

$$= 0.67 \times 1.4$$

$$= 0.938$$

The expect no. of day which not more one flat tire

$$= 0.938 \times 100 = 93.8 = 94\ days$$

$$(ii)\ P(2 < x < 5) = P(x=3) + P(x=4)$$

$$= \frac{e^{-0.4} \times (0.4)^3}{3!} + \frac{e^{-0.4} \times (0.4)^4}{4!}$$

$$= e^{-0.4}\left[0.0106 + 0.0011\right]$$

$$= 0.67 \times 0.0117$$

$$= 0.0078$$

The expect no. of day which not more one flat tire

$$= 0.0078 \times 100 = 0.78 = 1\ day$$

Splices in a certain recording tape occur at random, but on the average of one per 2000 feet. Assume a Poission distribution what is the probability that a 5000 feet root of tape has ( i ) no splices? ( ii ) at most two splices ? ( iii ) at least two splices ?. ( $e^{-2.5} = 0.082$ )

Solution

x be the the number of splices in the given length 5000ft

$$\lambda = \frac{1}{20000} = 0.0005 \qquad l = 5000$$

$$\mu = \lambda l = 0.0005 \times 5000 = 2.5$$

$$P(x = k) = \frac{e^{-\lambda l} (\lambda l)^k}{k!} \quad , k = 0,1,2,3,4,....$$

$$(i)P(x=0) = \frac{e^{-2.5} \times (2.5)^0}{0!} = 0.082$$

$$(ii)P(x \leq 2) = P(x=0) + P(x=1) + P(x=2)$$

$$= \frac{e^{-2.5} \times (2.5)^0}{0!} + \frac{e^{-2.5} \times (2.5)^1}{1!} + \frac{e^{-2.5} \times (2.5)^2}{2!}$$

$$= e^{-2.5} \left[1 + 2.5 + 3.125\right]$$

$$= 0.082 \times 6.625$$

$$= 0.54325$$

$$(iii)\ P(x \geq 2) = 1 - \{\ P(x=0) + P(x=1)\}$$

$$= 1 - \left[ \frac{e^{-2.5}\ (2.5)^0}{0!} + \frac{e^{-2.5}\ (2.5)^1}{1!} \right]$$

$$= 1 - e^{-2.5}\ [1 + 2.5\ ]$$

$$= 1 - 0.082 \times 2.5$$

$$= 0.731$$

Flows in the planting of target sheet of metal occurs at random. On the average of one in each section of area 10 squar feet. What is the probability that a 5 by 8 will have ( i ) no flows ? ( ii ) at most one flows ? ( $e^{-4} = 0.0183$ )

Solution

x be the the number of flows in the given area 40 sq ft

$$\lambda = \frac{1}{10} = 0.1 \qquad a = 5 \times 8 = 40$$

$$\mu = \lambda a = 0.1 \times 40 = 4$$

$$P(x = k) = \frac{e^{-\lambda a} (\lambda a)^k}{k!} \qquad , k = 0,1,2,3,....$$

$$(i)P(x=0) = \frac{e^{-4}\times(4)^0}{0!} = 0.0183$$

$$(ii)P(x\le 1) = P(x=0) + P(x=1)$$

$$= \frac{e^{-4}\times(4)^0}{0!} + \frac{e^{-4}\times(4)^1}{1!}$$

$$= e^{-4}\times\left[1+4\right]$$

$$= 0.0183\times 5$$

$$= 0.0915$$

Failure of electron taken airborn applications have been found to follow clearly poisson postulates. A recever with sixtten tubes suffers. A tube failure on the average of one every 50 hours of operating time. ( i ) What is the probability of more than one failure on an 8 hours missin ? ( ii ) What is the expected number of failures in 1000 hours of operation time ? ( $e^{-0.16} = 0.8521$ )

Solution

x be the the number of tube failure on the given time

$$\lambda = \frac{1}{50} = 0.02 \qquad t = 8$$

$$\mu = \lambda t = 0.02 \times 8 = 0.16$$

$$P(x = k) = \frac{e^{-\lambda t} (\lambda t)^k}{k!} \qquad , k = 0,1,2,3,4,5$$

$$(i)\,P(x>1)=1-\{\,P(x=0)+P(x=1)\}$$

$$=1-\left[\frac{e^{-0.16}\,(0.16)^0}{0!}+\frac{e^{-0.16}\,(0.16)^1}{1!}\right]$$

$$=1-e^{-0.16}\,[1+0.16]$$

$$=1-0.8521\times 1.16$$

$$=0.0116$$

$$(ii)\ \lambda=\frac{1}{50}=0.02 \qquad ,\ t=1000$$

$$\mu=\lambda\,t=0.02\times 1000=20$$

*Expecied number of failure in* 1000 *hours is* 20

A book containing 750 pages has 500 misprints. Assume that the misprints occur at random, find the probability that a particular page contain ( i ) no misprint ( ii ) exactly 4 misprints ( iii ) more than 2 misprints. ( $e^{-0.67} = 0.512$ )

Solution

x be the the number of misprints in a particular page

$$\lambda = \frac{500}{750} = 0.67$$

$$P(x = k) = \frac{e^{-\lambda} (\lambda)^{k}}{k!} \qquad , k = 0,1,2,3,4,5$$