# Tutorial - 2

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(1)

Using Binomial Probability,

$$P(X=k) = C_k^n \cdot p^k \cdot q^{n-k} = \frac{n!}{k!\,(n-k)!} p^k (1-p)^{n-k}$$

Addition Rule:

$$P(A \cup B) = P(A \text{ or } B) = P(A) + P(B) \quad \text{--- (1)}$$

Complement Rule

$$P(A^c) = P(\text{not } A) = 1 - P(A) \quad \text{--- (2)}$$

Num of trials = 9 = n

Probability = P = 99% = 0.99 ← (3)

(a) At lease 1 alarm is triggered

Evaluation the definition of B.P at K = 0.

$$P(X=0) = C_0^9 \times 0.99^0 \cdot (1-0.99)^{9-0} = \frac{9!}{0!\,(9-0)!} \cdot (0.99)^0 \cdot (0.01)^9$$

$$= 0$$

using (1)

$$P(X \geq 1) = 1 - P(X=0) = 1$$

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(b) ~~Evaluate~~ More than 7 alarms are triggered:

No. of trials $= n = 9$
$p = 0.99$.
$K = 8, 7$.

$P(x=8) = C^9_8 \times (0.99)^8 \cdot (1-0.99)^{9-8} = \cancel{\frac{9!}{8!(9-8)!}} \; 0.083$

$P(x=9) = C^9_9 \cdot (0.99)^9 \cdot (1-0.99)^0 = 0.9135$

We will use addition Rule :-
$P(x>7) = P(x=8) + P(x=9)$
$= 0.083 + 0.9135$
$= 0.9966$.

(c)
$P(x=9) = C^9_9 \cdot (0.99)^9 \cdot (1-0.99)^{9-9} = 0.9135$.

$P(x \leq 8) = 1 - P(x=9)$
$= 1 - 0.9135$
$= 0.0865$.

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2) $n =$ No. of trials $= 4$
$p =$ Probability $= 30\% = 0.3$.

(a) $P(x=4) = C^4_4 \cdot 0.3^4 \cdot (1-0.3)^{4-4} = 0.0081$

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(b) $P(x=1) = C_1^4 \cdot 0.3^1 \cdot (1-0.3)^{4-1} = 0.4116$

(c) $P(x=0) = C_0^4 \times (0.3)^0 \times (1-0.3)^{4-0} = 0.2401$

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(3)

(4) $n$ = no. of trials = 8

$p$ = probability = 0.6

(a) $P(x=8) = C_8^8 \cdot (0.6)^8 \cdot (1-0.6)^{8-8} = 0.016796$

(b) $P(x=8) = 0.016796$ is correct, because we note that row starting with 8 of the probability density function contains 0.016796.

(c) ~~Total~~ Probability = $P(x \leq 7)$

$P(x \leq 7) = 0.98320$

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(5) $n$ = No. of trials = 25.
$p$ = probability = 40% = 0.40.

(a) Mean $(\mu) = n \times p$.
$= 25 \times 0.4 = 10$.

variance $(\sigma) = npq$.
$= np(1-p) = 25(0.4)(1-0.4)$
$= 6$

$\sigma = \sqrt{6} = 2.4495$.

(b) Let us determine value of $\mu \pm 2\sigma$.

$\mu - 2\sigma = 10 - 2(2.4495) = 5.1010$.
$\mu + 2\sigma = 10 + 2(2.4495) = 14.8990$.

It contains value from 6 to 4 (Integers).

(c) $P(6 \leq x \leq 14) = P(x=6) + P(x=7) + P(x=8) + P(x=9)$
$+ P(x=10) + P(x=11) + P(x=12) + P(x=13)$
$+ P(x=14)$.
~~= 0.~~
$= 0.9364$.

Teacher's Signature

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(6)
(a) $\int_{-\infty}^{\infty} f(y)\,dy = 1$

$\Rightarrow 1 = \int_{-\infty}^{\infty} f(y)\,dy = \int_0^1 Ky^4(1-y^3)\,dy$

$= K\int_0^1 (y^4 - 3y^5 + 3y^6 - y^3)\,dy.$

$= K\left[\frac{1}{5}y^5 - \frac{1}{2}y^6 + \frac{3}{7}y^7 - \frac{1}{8}y^8\right]_0^1$

$= K\left(\frac{1}{5} - \frac{1}{2} + \frac{3}{7} - \frac{1}{8}\right) = \frac{K}{280}$

(b) $P(Y < 0.6) = P(0 \le Y \le 0.6)$

$= \int_0^{0.6} 280\, y^4(1-y)^3\,dy.$

$= 280 \int_0^{0.6} \left(\frac{1}{5}y^5 - \frac{1}{2}y^6 + \frac{3}{7}y^7 - \frac{1}{8}y^8\right)\Big|_0^{0.6}$

$= 280\left(\frac{1}{5}\cdot 0.6^5 - \frac{1}{2}0.6^6 + \frac{3}{7}0.6^7 - \frac{1}{8}0.8^6\right)$

$=$

(c) $P(Y \ge 0.9) = P(Y \ge 0.9)$

$= 1 - P(0 \le Y \le 0.9)$

$= 1 - \int_0^{0.9} 280\,y^4(1-y^3)\,dy.$

$= 1 - 280\left(\frac{1}{5}y^5 - \frac{1}{2}y^6 + \frac{3}{7}y^7 - \frac{1}{8}y^8\right)_0^{0.9}$

$= 1 - 280\left(\frac{1}{5}0.9^5 - \frac{1}{2}0.9^6 + \frac{3}{7}0.9^7 - \frac{1}{8}0.9^8\right)$

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