

# Q-10.13.3.10

Yash Patil - EE22BTECH11058

**Question:** A die is tossed twice. A ‘success’ is getting an even number on a toss. Find the variance of the number of successes.

**Solution:**

Parameter	Value	Description
$X_i$	0,1	0-Not a success, 1-Success and it represents outcome of $i^{th}$ throw
$Y$	0-2	Represents number of successes in 2 throws

pmf of  $X_i$ :

$$p_{X_i}(k) = \begin{cases} \frac{1}{2}, & k = 0 \\ \frac{1}{2}, & k = 1 \end{cases} \quad \forall \quad 1 \leq i \leq 2 \quad (1)$$

pmf of  $Y$  is given by:

$$p_Y(k) = \binom{2}{k} (0.5)^{2-k} \times (0.5)^k \quad \forall \quad 0 \leq k \leq 2 \quad (2)$$

$$\therefore p_Y(k) = \begin{cases} \frac{1}{4}, & k = 0 \\ \frac{1}{2}, & k = 1 \\ \frac{1}{4}, & k = 2 \end{cases} \quad (3)$$

Variance of number of successes is given by:

$$\sigma^2 = E(Y^2) - [E(Y)]^2 \quad (4)$$

$$= \sum_{k=0}^2 (k^2 \times p_Y(k)) - \left[ \sum_{k=0}^2 k \times p_Y(k) \right]^2 \quad (5)$$

$$= \frac{3}{2} - 1 \quad (6)$$

$$= \frac{1}{2} \quad (7)$$