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Shubham Shetty.

Tutorial - 6

q1 a) $P(H) = \lambda$, $P(T) = 1-\lambda$

$P(H \text{ at } K+1^{th} \text{ toss}) = P(T \text{ at } K \text{ toss} \;\&\; H \text{ at } K+1^{th})$

$= (1-\lambda)^K \cdot \lambda$

(b) Let $m \rightarrow$ No. of tosses to get first head

$S = E(m)$

Now,

$S = \lambda \times 1 + (1-\lambda) \cdot (S+1)$

$S = \lambda + S - \lambda S - \lambda$

$$\boxed{S = \frac{1}{\lambda}}$$

q2)

(a) $Var(x) = E[(x - E(x))^2]$

Now,

$Var(x) = E[x^2 - 2xE[x] + E[x]^2]$

$= E[x^2] - 2E[xE[x]] + E[x]^2$

$= E[x^2] - 2E[x]^2 + E[x]^2$

$= E[x^2] - E[x]^2$

(b) $E[x] = 0$ & $E[x^2] = 1$

(1) $Var(x) = E[x^2] - [E[x]]^2$

$= 1 - 0 = 1$

(2) $Y = a + bx$

$E[Y^2] = E[(a+bx)^2]$

$= E[a^2 + 2abx + b^2x^2]$

$= a^2 + 2ab\,E[x] + b^2 E[x^2]$

$= a^2 + b^2$

$E[Y] = E[a+bx] = a + b\,E[x]$

$E[Y] = a$

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

$= a^2 + b^2 - a^2$

$= \underline{b^2}$

Q3 Let $A \rightarrow$ Aku predicts given horse is winning

Let $\sim A \rightarrow$ " " " " " not "

Ily $B \rightarrow$ event that given horse wins

$\sim B \rightarrow$ " " " " does not win.

(a) $P(B) = P(B, A) + P(B \cap A)$

$= P(B/A)\,P(A) + P(B/\sim A)\,P(\sim A)$

$= 1.99 \times 10^{-5}$

(b) $P(A/B) = \frac{P(A,B)}{P(B)} = \frac{P(A/B)\,P(A)}{P(B)}$

$$\boxed{P(A/B) = 0.497}$$