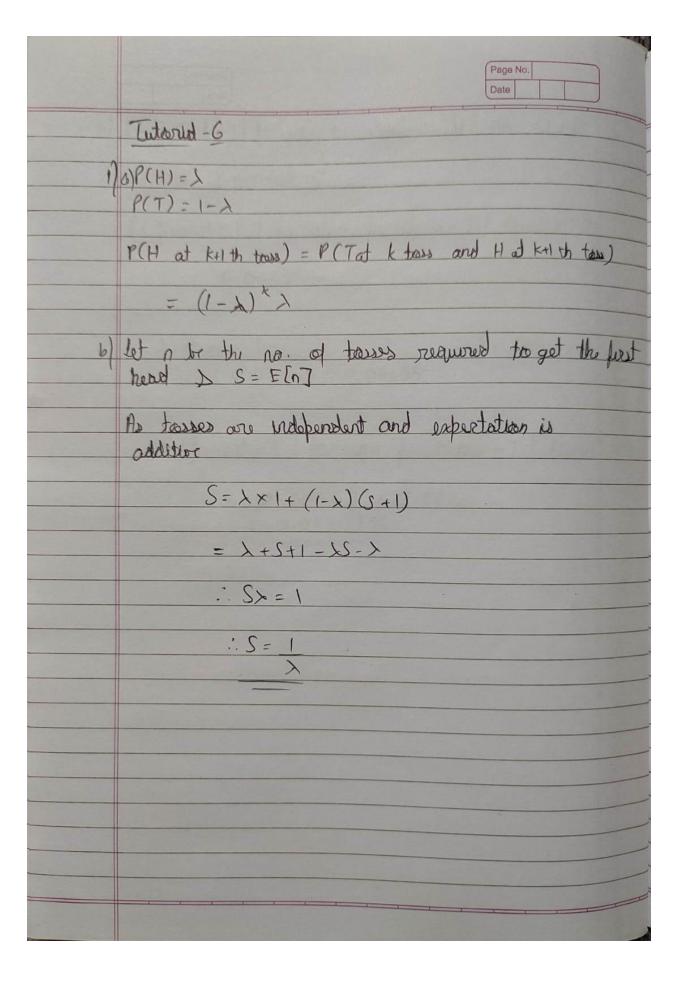
Jay Mehta 2018130024

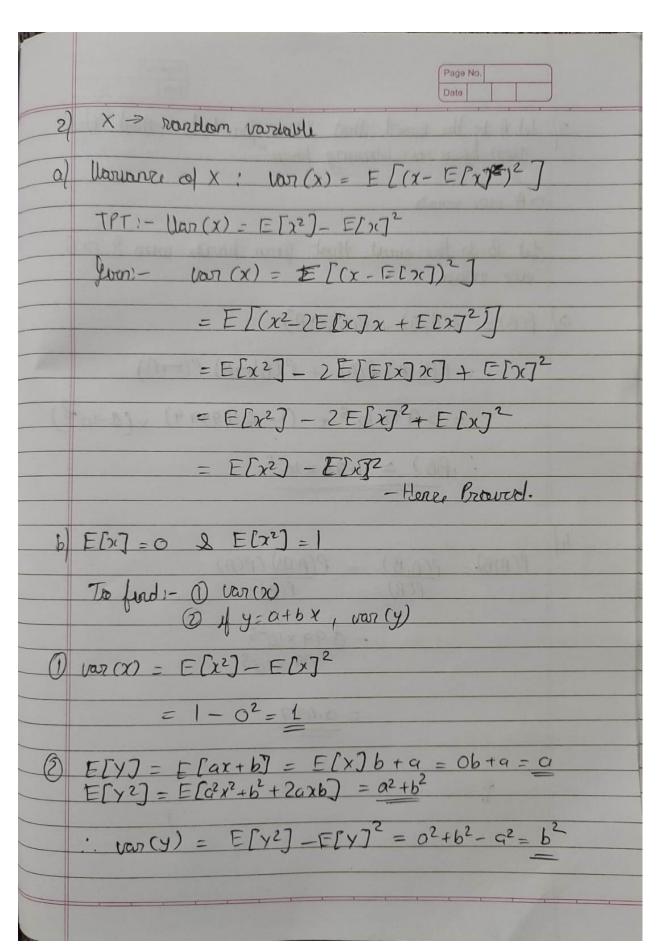
Data Science, 2022

Tut 6: Machine Learning 1

- 1. [Probability] Assume that the probability of obtaining heads when tossing a coin is λ .
- a. What is the probability of obtaining the first head at the (k + 1)-th toss?



- 2. [Probability] Assume X is a random variable.
- a. We define the variance of X as: $Var(X) = E[(X E[X])^2]$. Prove that $Var(X) = E[X^2] E[X]^2$.
- b. If E[X] = 0 and $E[X^2] = 1$, what is the variance of X? If Y = a + bX, what is the variance of Y?



- 3. [Probability] Your friend Aku is a great predictor about winning a horse race. Assume that we know three facts: 1) If Aku tells you that a horse name black beauty will win, it will win with probability 0.99. 2) If Aku tells you that a black beauty will not win, it will not win with probability 0.99999. 3) With probability 10^{-5} , Aku predicts that a black beauty is a winning horse. This also means with probability $1 10^{-5}$, Aku predicts that a black beauty will not win.
- a. Given a horse, what is the probability that it wins?
- b. What is the probability that Aku correctly predicts a black beauty is winning?

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3	Let A be the surert that "Aku preducts that the given horse".
	Let B in the event that goin house wins & MB ville vorsa.
a)	$P(B) = P(B,A) + P(B, \neg A)$ $= P(B A) + P(B A) + P(B A) + P(B A)$
	$= 0.99 \times 10^{-5} + (1 - 0.99999) \times (1 - 10^{-5})$
	: ,PB) ≈ 1.99×10 ⁻⁵
b/	P(A B) = P(A B) = P(A B)(P(A)) $P(B)$ $P(B)$
	- 0.99 × 10-5 1.99 × 10-5
	= 0.497