

# COMP 2711 Tutorial

Week 9

October 31, 2017

# Who is this guys?

- ▶ New TA responsible for the rest of semester
- ▶ Graduated from HKUST (ask me anything if you have other question as well)
- ▶ Speak English, Mandarin, and native in cantonese.
- ▶ Machine learning in education is what I am doing now.
- ▶ It has been 4 years ago when I took COMP 2711 in my UG.

Question 2(1): Prove that  $\text{Var}(X) = E(x^2) - (E(x))^2$ .

Recall that  $\text{Var}(X) = E(x - E(x))^2$ , then

$$\begin{aligned} E(x - E(x))^2 &= \frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})^2 \\ &= \dots \end{aligned}$$

Question 2(2):  $E(X) = 3$ ,  $Var(X) = 2$ , and  $Y = 10X$ .  
What is  $E(Y)$  and  $Var(Y)$ ?

$$\begin{aligned} E(x - E(x))^2 &= \frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})^2 \\ &= \frac{1}{n} \sum_{i=1}^n (x_i^2 - 2x_i\bar{x} + \bar{x}^2) \\ &= \frac{\sum_{i=1}^n x_i^2}{n} - 2\bar{x} \frac{\sum_{i=1}^n x_i}{n} + \frac{\sum_{i=1}^n \bar{x}^2}{n} \\ &= E(x^2) - \frac{\bar{x}^2}{n} \\ &= E(x^2) - (E(x))^2 \end{aligned}$$

What happened if we replace  $x = 10z$ ?

Question 5: show that if  $X$  and  $Y$  are independent,  $b$  and  $c$  are constant, then  $X - b$  and  $Y - c$  are independent.

Example: Consider  $X$  and  $Y$  be the random variable representing the integer drawn from the set  $\mathbb{Z}$ . If  $X$  and  $Y$  are independent, adding an arbitrary constant to them will remain independent.

## Question 6: TL;DW :)

Denote  $X_i$  be the value of coins in  $i^{th}$  draw.

$$\begin{aligned} P(X_2 = 1) &= P(X_2 = 1 | X_1 \neq 1)P(X_1 \neq 1) + P(X_2 = 1 | X_1 = 1)P(X_1 = 1) \\ &= \left(\frac{1}{2}\right)\left(\frac{2}{3}\right) + (0)\left(\frac{1}{3}\right) \end{aligned}$$

## Question 8: TL;DW :)

Hint:  $\gcd(6, 10) = 2$