

Instructions

1. Separate into groups of no more than three persons.
2. The group cannot be the same as your former group.
3. Only one submission is needed for each group.
4. **Write down all the steps** that you have done to obtain your answers. You may not get full credit even when your answer is correct without showing how you get your answer.
5. **Do not panic.**

Date: <u>09</u> / <u>02</u> / 2017			
Name	ID (last 3 digits)		
Prapun	5	5	5

1. No need to provide any explanation for this question.

Consider a DMC whose samples of input and output are provided below

x: 1 1 1 0 1 0 1 0 1 1 1 1 1 1 1

y: 1 1 1 0 1 0 1 1 1 1 1 1 1 1 1

Estimate the following quantities:

a. $\mathcal{X} = \{0, 1\}$

b. $P[X = 0] \approx \frac{3}{15} = \frac{1}{5} = 0.2$

c. $p(1) \equiv P[X = 1] \approx \frac{12}{15} = \frac{4}{5} = 0.8$

d. $p_Y(0) \equiv P[Y = 0] \approx \frac{2}{15} \approx 0.133$

e. $\underline{p} = [0.2 \quad 0.8]$

f. $q(1) \equiv P[Y = 1] \approx \frac{13}{15} \approx 0.867$

g. $P[Y = 0 | X = 0] \approx \frac{2}{3} \approx 0.667$

h. $p_{Y|X}(1|0) \equiv P[Y = 1 | X = 0] \approx \frac{1}{3} \approx 0.333$

i. $Q(0|1) \equiv P[Y = 0 | X = 1] \approx \frac{0}{12} = 0$

j. $Q(1|1) \equiv P[Y = 1 | X = 1] \approx \frac{12}{12} = 1$

k. Matrix $\mathbf{Q} \approx \begin{matrix} & \begin{matrix} X=0 & X=1 \end{matrix} \\ \begin{matrix} Y=0 \\ Y=1 \end{matrix} & \begin{bmatrix} 0 & 1 \\ 2/3 & 1/3 \\ 0 & 1 \end{bmatrix} \end{matrix}$

l. $P[X = 0, Y = 0] \approx \frac{2}{15}$ ← Note that this is the same as $P[Y = 0 | X = 0] P[X = 0]$
 $\frac{2}{3} \times \frac{1}{5} = \frac{2}{15}$