



**PES University, Bangalore**

(Established under Karnataka Act No. 16 of 2013)

**UE19CS203 – STATISTICS FOR DATA SCIENCE**

**Unit-2 - Random Variables**

**QB SOLVED**

**Bernoulli Distribution**

**Exercises for Section 4.1**

**1. Let X and Y be Bernoulli random variables. Let  $Z = X + Y$ .**

- a) Show that if X and Y cannot both be equal to 1, then Z is a Bernoulli random variable.**
- b) Show that if X and Y cannot both be equal to 1, then  $p_Z = p_X + p_Y$ .**
- c) Show that if X and Y can both be equal to 1, then Z is not a Bernoulli random variable.**

**[Text Book Exercise – Section 4.1 – Q. No.4 – Pg. No. 203]**

**Solution**

- a) Show that if X and Y cannot both be equal to 1, then Z is a Bernoulli random variable.**

It is given that  $X \sim \text{Bernoulli}(p_X)$ .

$Y \sim \text{Bernoulli}(p_Y)$ .

So, the possible values of Z are 0 and 1 (when  $X = 0$  or  $1$  and  $Y = 0$  or  $1$ ).

X and Y both cannot be equal to 1. Because the possible values of Z can be 0 or 1.

Therefore, Z is a Bernoulli random variable.

- b) Show that if X and Y cannot both be equal to 1, then  $p_Z = p_X + p_Y$ .**

If X and Y cannot be both equal to 1, then  $p_Z = p_X + p_Y$

$$P_Z = P(X = 1 \text{ or } Y = 1)$$

$$= P(X = 1) + P(Y = 1) - P(X = 1 \text{ and } Y = 1)$$

$$= P(X = 1) + P(Y = 1)$$

$$= P_X + P_Y$$

- c) **Show that if X and Y can both be equal to 1, then Z is not a Bernoulli random variable.**

If X and Y both equal to 1, then  $Z = 2$ .

So, the possible values of Z are 0, 1, 2.

$$P(X = 1 \text{ and } Y = 1) \neq 0 \quad (Z = 2)$$

Z can take only 0 and 1. So, Z is not a Bernoulli random variable.

