Assignment 6

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June 6, 2022

Question

Papoulli Chapter 6(Ex 6.67) : Show that,if the random variable x is of discrete type taking the values x_n with $P\{x = x_n\} = p_n$ and z = g(x,y), then

$$E\{z\} = \sum_n E(g(x_n, y))p_n$$

$$f_z(z) = \sum_n f_z(z|x_n)p_n$$

Theory

$$E\{g(X,Y)|x\} = \int_{-\infty}^{\infty} g(x,y)f(y|x)dy \tag{1}$$

The conditional mean of g(y)

$$E\{g(y)|M\} = \int_{-\infty}^{\infty} g(y)f(y|M)dy \tag{2}$$

From (2), we can say that

$$E\{g(x,y)|x\} = \int_{-\infty}^{\infty} g(x,y)f(y|x)dy \tag{3}$$

Theory

From (1) and (3) we can say that

$$E\{g(X, Y)|x\} = E\{g(x, y)|x\} \tag{4}$$

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From (4), we can say that

$$E\{g(x,y)\} = E\{E\{g(x,y)|y\}\} = E\{g(x_n,y)P\{x = x_n\}\} \tag{5}$$

$$E\{z\} = \sum_n E(g(x_n,y))p_n \tag{6}$$

we know from Bayes theorm that,

$$f(x) = f(x|A_1)P(A_1) + f(x|A_2)P(A_2) + ... + f(x|A_n)P(A_n) \tag{7}$$

putting $A_n = \{x = x_n\}$

$$f_z(z) = \sum_n f_z(z|x = x_n)P\{x = x_n\}$$