AI1103-Assignment 2

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Download latex-tikz codes from

https://github.com/asishcs2011010/demo/blob/main/Assignment−2/assignment−2(2).tex

QUESTION NO

Gate-EC Q-38

QUESTION

Let $X \in \{0,1\}$ and $Y \in \{0,1\}$ be two independent binary random variables. if P(X = 0) = p and P(Y = 0) = q, then P($X + Y \geqslant 1$) is equal to

1) $pq + (1-p)(1-q)$

2) pq

3) $p(1-q)$

4) $1 - pq$

SOLUTION

Given Pr (X = 0) = p , Pr(Y=0) = q and X and Y are independent binary random variables.

X	$X = 0$	$X = 1$
Pr	p	$1-p$

Y	$Y = 0$	$Y = 1$
Pr	q	$1-q$

.

Let Z be the convolution of X,Y.

$$Z = X + Y, \tag{0.0.1}$$

$$\Pr(Z = z) = \sum \Pr(X = k) \times \Pr(Y = z - k) \tag{0.0.2}$$

$$\Pr(Z < 1) = \mathrm{P}(Z = 0)(Z = 0, 1, 2) \tag{0.0.3}$$

From equation (0.0.3), we get

$$Pr(Z = 0) = \sum Pr(X = k) \times Pr(Y = z - k) \tag{0.0.4}$$

$$= Pr(X = 0) \times Pr(Y = 0) = pq \tag{0.0.5}$$

$$Pr(X + Y \geq 1) = 1 - Pr(X + Y < 1) \tag{0.0.6}$$

$$Pr(Z \geq 1) = 1 - Pr(Z < 1 = 1 - pq \tag{0.0.7}$$