AI1110 Assignment 1 in LaTeX

Kondaparthy Anuraga Chandan*

12.13.2.7

Given that the events A and B are such that $\Pr(A) = \frac{1}{2}$, $\Pr(A+B) = \frac{3}{5}$ and $\Pr(B) = p$. Find p if they are (i) mutually exclusive (ii) independent.

Solution:

Given,

$$\Pr(A) = \frac{1}{2} \tag{1}$$

$$\Pr(A+B) = \frac{3}{5} \tag{2}$$

$$\Pr(B) = p = ? \tag{3}$$

(i) A and B are *mutually exclusive* events

$$AB = 0 \tag{4}$$

$$(A+B) = (A) + (B) - (AB) \tag{5}$$

$$(A+B) = (A) + (B) \tag{6}$$

$$\Pr(A+B) = \Pr(A) + \Pr(B) \tag{7}$$

$$\Pr(B) = \Pr(A+B) - \Pr(A) \tag{8}$$

$$\Pr(B) = \frac{3}{5} - \frac{1}{2} = \frac{6-5}{10} \tag{9}$$

$$\Pr(B) = \frac{1}{10} \tag{10}$$

(ii) A and B are *independent* events

*The student is with the Department of Artificial Intelligence, Indian Institute of Technology, Hyderabad 502285 India e-mail: ai22btech110011@iith.ac.in.

$$\Pr(AB) = \Pr(A)\Pr(B) \tag{11}$$

$$\Pr(A + B) = \Pr(A) + \Pr(B) - \Pr(AB) \tag{12}$$

$$\Pr(A + B) = \Pr(A) + \Pr(B) - \Pr(A)\Pr(B) \tag{13}$$

$$\Pr(A + B) - \Pr(A) = \Pr(B)\left[1 - \Pr(A)\right] \tag{14}$$

$$\Pr(B) = \frac{\Pr(A + B) - \Pr(A)}{1 - \Pr(A)} \tag{15}$$

$$\Pr(B) = \frac{\frac{3}{5} - \frac{1}{2}}{1 - \frac{1}{2}} = \frac{\frac{6-5}{10}}{\frac{1}{2}} = \frac{\frac{1}{10}}{\frac{1}{2}} \tag{16}$$

$$\Pr(B) = \frac{2}{10} \tag{17}$$