Solution to Q12.13.3.39

Mayank Gupta

Question: Two dice are tossed. Find whether the following two events A and B are independent: A = {(x,y) : x+y=11} B = {(x,y): x ≠ 5}
where (x,y) denotes a typical sample point.
Solution: We know that

random variables	**description**
X	number appearing on first dice
Y	number appearing on second dice
Z	Sum of numbers appearing on both dice

TABLE 0
TWO DICE ROLL

$$p_Z(n) = \begin{cases} 0 & n \le 1 \\ \frac{n-1}{36} & 2 \le n \le 6 \\ \frac{13-n}{36} & 7 \le n \le 12 \\ 0 & n \ge 13 \end{cases} \tag{1}$$

$$\Pr(A) = p_Z(11) \tag{2}$$
$$= \frac{1}{18} \tag{3}$$
$$\Pr(B) = 1 - p_X(5) \tag{4}$$
$$= 1 - \frac{1}{6} \tag{5}$$
$$= \frac{5}{6} \tag{6}$$
$$\Pr(AB) = p_{XY}(6,5) \tag{7}$$
$$= p_X(6) \times p_Y(5) \tag{8}$$
$$= \frac{1}{36} \tag{9}$$
$$\Pr(A) \times \Pr(B) = \frac{5}{108} \tag{10}$$

$\because \Pr(AB) \neq \Pr(A) \times \Pr(B)$
$\therefore$ A and B are not independent events