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Solution to Q12.13.3.39

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Question: Two dice are tossed. Find whether the following two events A and B are independent:

 $A = \{(x,y) : x+y=11\} B = \{(x,y): x \neq 5\}$ 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

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

$$Pr(A) = p_Z(11) \tag{2}$$

$$=\frac{1}{18}\tag{3}$$

$$Pr(B) = 1 - p_X(5) \tag{4}$$

$$=1-\frac{1}{6}$$
 (5)

$$=\frac{5}{6}\tag{6}$$

$$Pr(AB) = p_{XY}(6,5) \tag{7}$$

$$= p_X(6) \times p_Y(5) \tag{8}$$

$$=\frac{1}{36}\tag{9}$$

$$= \frac{1}{36}$$
 (9)

$$Pr(A) \times Pr(B) = \frac{5}{108}$$
 (10)

 $\therefore \Pr(AB) \neq \Pr(A) \times \Pr(B)$

:. A and B are not independent events