Assignment 5, AI1110

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***Abstract*—This document provides a solution to Question 3 from NCERT Class 11 Probability Ex 16.2**

Question 3: An experiment involves rolling a pair of dice and recording the numbers that come up. Describe the following events:

(i) A: the sum is greater than 8
(ii) B: 2 occurs on either die
(iii) C: the sum is at least 7 and a multiple of 3

Which pairs of these events are mutually exclusive?

Solution: Let $(X, Y) \in \{1, 2, 3, 4, 5, 6\}^2$ be a pair of random variables denoting the numbers observed on two dice. Let us define sets based on outcomes:

$$A = \{(X, Y) : X + Y > 8\} \tag{1}$$
$$B = \{(X, Y) : X = 2 \vee Y = 2\} \tag{2}$$
$$C = \{(X, Y) : X + Y \geq 7 \wedge (X + Y) \,|3\} \tag{3}$$

The following is a map of all outcomes. Letters indicate the sets which contain that outcome:

X\Y	1	2	3	4	5	6
1		B				
2	B	B	B	B	B	B
3		B				A,C
4		B			A,C	A
5		B		A,C	A	A
6		B	A,C	A	A	A,C

TABLE I
OUTCOMES AND SETS WHICH CONTAIN THEM

Two events are mutually exclusive if their outcome sets are disjoint.

$$A \cap B = \phi \tag{4}$$
$$B \cap C = \phi \tag{5}$$
$$C \cap A = \{(6, 3), (5, 4), (4, 5), (3, 6), (6, 6)\} \tag{6}$$

$\therefore$ A, B and B, C are pairs of mutually exclusive events.