

Assignment 5 (NCERT Class 12)

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Abstract—This document contains the solution to Question 7 of Exercise 13.2 in Chapter 13 (Probability) of the NCERT Class 12 Mathematics Textbook.

Exercise 13.2, Q7. Given that the events A and B are such that $\Pr(A) = \frac{1}{2}$, $\Pr(A \cup B) = \frac{3}{5}$ and $\Pr(B) = p$. Find p if they are:

- (i) mutually exclusive
- (ii) independent

Solution: We know that, given events A and B,

$$\Pr(A + B) = \Pr(A) + \Pr(B) - \Pr(AB) \quad (1)$$

and also, for mutually exclusive events

$$\Pr(AB) = 0 \quad (2)$$

and for independent events

$$\Pr(AB) = \Pr(A) \times \Pr(B) \quad (3)$$

- (i) Using (1) and (2), we get

$$\frac{3}{5} = \frac{1}{2} + p - 0 \quad (4)$$

$$\Rightarrow p = \frac{3}{5} - \frac{1}{2} \quad (5)$$

$$\Rightarrow p = \frac{6-5}{10} = \frac{1}{10} \quad (6)$$

$$(7)$$

- (ii) From (1) and (3),

$$\frac{3}{5} = \frac{1}{2} + p - \frac{p}{2} \quad (8)$$

$$\Rightarrow \frac{3}{5} = \frac{1}{2} + \frac{p}{2} \quad (9)$$

$$\Rightarrow \frac{p}{2} = \frac{3}{5} - \frac{1}{2} \quad (10)$$

$$\Rightarrow \frac{p}{2} = \frac{6-5}{10} \quad (11)$$

$$\Rightarrow \frac{p}{2} = \frac{1}{10} \quad (12)$$

$$\therefore p = \frac{1}{5} \quad (13)$$

following:

$$A + B = A(B + B') + B(A + A') \quad (14)$$

$$= (AB + BA) + AB' + A'B \quad (15)$$

$$= AB + AB' + A'B \quad (16)$$

and

$$\Pr(A) = \Pr(AB') + \Pr(AB) \quad (17)$$

Thus, taking probabilities in (16), since all the events are mutually disjoint,

$$\Pr(A + B) = \Pr(AB') + \Pr(AB) + \Pr(A'B) \quad (18)$$

$$= \Pr(A) + \Pr(B) - \Pr(AB) \quad (19)$$

$$= \Pr(A) + \Pr(B) - \Pr(AB) \quad (20)$$

Note: Derivation of (1) using Boolean Algebra: We note that for any events A and B we have the