

# Assignment 7 (NCERT Class 12)

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**Abstract**—This document contains the solution to Question 5 of Exercise 13.1 in Chapter 13 (Probability) of the NCERT Class 12 Mathematics Textbook.

The following identities were used:

$$\text{(De-Morgan's Law)} \quad (A \vee B)' = A' \wedge B' \quad (11)$$

$$A' = 1 - A \quad (12)$$

$$A \wedge B = AB \quad (13)$$

**Exercise 13.1, Q5.** If  $\Pr(A) = \frac{6}{11}$ ,  $\Pr(B) = \frac{5}{11}$  and  $\Pr(A \cup B) = \frac{7}{11}$ , find

(i)  $\Pr(A \cap B)$

(ii)  $\Pr(A|B)$

(iii)  $\Pr(B|A)$

**Solution:** Define the random variables  $X$  and  $Y$  as follows:

$$X = \begin{cases} 0, & \text{event A occurs} \\ 1, & \text{otherwise} \end{cases} \quad (1)$$

$$Y = \begin{cases} 0, & \text{event B occurs} \\ 1, & \text{otherwise} \end{cases} \quad (2)$$

We know that, given events A and B,

$$\Pr(AB) = \Pr(A) + \Pr(B) - \Pr(A + B) \quad (3)$$

and also,

$$\Pr(A|B) = \frac{\Pr(AB)}{\Pr(B)} \quad (4)$$

Using (2) and (3), we get

$$\Pr(X = 0, Y = 0) = \frac{6}{11} + \frac{5}{11} - \frac{7}{11} = \frac{4}{11} \quad (5)$$

From (4) and (5),

$$\Pr(X = 0|Y = 0) = \frac{\Pr((X = 0)(Y = 0))}{\Pr(Y = 0)} = \frac{4}{5} \quad (6)$$

and

$$\Pr(X = 0|Y = 0) = \frac{\Pr((X = 0)(Y = 0))}{\Pr(X = 0)} = \frac{2}{3} \quad (7)$$

The C code `./codes/7_1.c` verifies the solution, within limits of float precision.

**Note:** Derivation of (3) using Boolean Algebra:

$$LHS = A \vee B = (A' \wedge B')' \quad (8)$$

$$= 1 - (1 - A)(1 - B) \quad (9)$$

$$= A + B - AB = RHS \quad (10)$$