

Assignment 7 (NCERT Class 12)

Gautam Singh (CS21BTECH11018)

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

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: We know that, given events A and B,

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

and also,

$$\Pr(A|B) = \frac{\Pr(A \cap B)}{\Pr(B)} \quad (2)$$

Using (1), we get

$$\Pr(A \cap B) = \frac{6}{11} + \frac{5}{11} - \frac{7}{11} = \frac{4}{11} \quad (3)$$

From (2) and (3),

$$\Pr(A|B) = \frac{\Pr(A \cap B)}{\Pr(B)} = \frac{4}{5} \quad (4)$$

and

$$\Pr(B|A) = \frac{\Pr(A \cap B)}{\Pr(A)} = \frac{2}{3} \quad (5)$$

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

Note: Derivation of (1) using Boolean Algebra:

$$LHS = A \vee B = \neg(\neg A \wedge \neg B) \quad (6)$$

$$= 1 - (1 - A)(1 - B) \quad (7)$$

$$= A + B - AB = RHS \quad (8)$$

The following identities were used:

$$\text{(De-Morgan's Law)} \quad \neg(A \vee B) = \neg A \wedge \neg B \quad (9)$$

$$\neg A = 1 - A \quad (10)$$

$$A \wedge B = AB \quad (11)$$