

## Conditional Probability

YASH GUPTA

S202000234

Q-1 If  $P(A) = \frac{9}{13}$ ,  $P(B) = \frac{7}{13}$ ,  $P(A \cap B) = \frac{4}{13}$

Calculate  $P(A/B)$

$$P(A/B) = \frac{P(A \cap B)}{P(B)} = \frac{4/13}{7/13} = \frac{4}{7}$$

Q-2

A die is thrown 2 times. Events A and B are as follows

A  $\rightarrow$  3 on 2<sup>nd</sup> throw

B  $\rightarrow$  ~~1, 2~~ Even number on the first throw.

Find the probability of A given that B has already happened.

$$A = \left[ \begin{array}{ccc} (1, 3) & (2, 3) & (3, 3) \\ (4, 3) & (5, 3) & (6, 3) \end{array} \right]$$

$$B = \left[ \begin{array}{cccccc} (2, 1) & (2, 2) & (2, 3) & (2, 4) & (2, 5) & (2, 6) \\ (4, 1) & (4, 2) & (4, 3) & (4, 4) & (4, 5) & (4, 6) \\ (6, 1) & (6, 2) & (6, 3) & (6, 4) & (6, 5) & (6, 6) \end{array} \right]$$

$$A \cap B = \left[ (2, 3), (4, 3), (6, 3) \right]$$

$$P(B) = \frac{18}{36} = \frac{1}{2} \quad P(A \cap B) = \frac{3}{36} = \frac{1}{12}$$

$$P(A|B) = \frac{P(A \cap B)}{P(B)} = \frac{\frac{1}{12}}{\frac{1}{2}} = \frac{1}{6}$$

Q-3

A probability of an event  $A$  is  $\frac{1}{19}$ .  
Find  $P(A|S)$ , where  $S$  is sample space.

$$P(A|S) = \frac{P(A \cap S)}{P(A)} = \frac{P(A)}{P(A)} = 1$$

Q-4 What is the probability that the total of two dice will be greater than 9, given that the first die is a 5?

$$\cancel{P(A)} = A = \begin{matrix} (5,4) & (5,5) & (5,6) \\ (4,5) & (4,6) & (3,6) \\ (6,5) & (6,6) & (3,6) \end{matrix}$$

$$B = \{(5,1) (5,2) (5,3) (5,4) (5,5) (5,6)\}$$

$$A \cap B = \{(\cancel{5,4}) (5,5) (5,6)\}$$

$$\cancel{P(A \cap B)} = \cancel{A}$$

$$P(A|B) = \frac{P(A \cap B)}{P(B)} = \frac{2/36}{6/36} = \frac{1}{3}$$

Q-5 A bag contains red and blue marbles. Two marbles are drawn without replacement.

The probability of selecting a red marble and then a blue marble is 0.28. The probability of selecting a red marble on the first draw is 0.5. What is the probability of selecting a blue marble on the second draw given that the first marble drawn was red?



Let A be the event of selecting a blue marble  
 $P(A) = 0.28$

Let B be the event of selecting a red marble  
~~Let B be the event of selecting a red marble~~

$$P(A \cap B) = 0.5$$

$$P(A|B) = \frac{P(A \cap B)}{P(B)} = \frac{0.28}{0.5} = 0.56$$

Q-6 find  $P(A \cup B)$ , if  $P(A) = \frac{2}{5}$   $P(B) = \frac{5}{13}$

$$\& P(A/B) = \frac{2}{5}$$

$$P(A/B) = \frac{P(A \cap B)}{P(B)}$$

$$\frac{2}{5} = \frac{P(A \cap B)}{5/13}$$

$$\frac{2}{5} \times \frac{5}{13} = P(A \cap B)$$

$$P(A \cap B) = \frac{1}{13}$$

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$= \frac{2}{5} + \frac{5}{13} - \frac{1}{13}$$

$$= \frac{2}{5} + \frac{4}{13}$$

$$= \frac{13}{26} + \frac{8}{13} = \frac{1}{2}$$

$$P(A \cup B) = \frac{1}{2}$$

Q-7

find  $P(A|B)$  if  $P(B) = 0.5$

&  $P(A \cap B) = 0.32$

$$P(A|B) = \frac{P(A \cap B)}{P(B)} = \frac{0.32}{0.5}$$

$$= 0.64$$