Examples for Probability

1) The Personnel Department of a company has records which show the following analysis of its 200 Engineers.

Age	Bachelor's degree only	Master's degree	Total
Under 30	90	10	100
30 to 40	20	30	50
Over 40	40	10	50
Total	150	50	200

If one Engineer is selected at random from the company, find:

a) The probability he has only a bachelor's degree.
b) The probability he has master's degree, given that he is over 40.
c) The probability he is under 30, given that he has only a bachelor's degree.

Example (2)

A market survey conducted in four cities pertained to preference for brand A soup. The responses are shown below:

	Dhaka	Chittagong	Khulna	Rajshahi
Yes	45	55	60	50
No	35	45	35	45
No opinion	5	5	5	5

(i) What is the probability that a consumer selected at random preferred brand A?

(ii) What is the probability that a consumer preferred brand A and was from Khulna?

(iii) What is the probability that a consumer preferred brand A given that he was from Khulna?

(iv) Given that a consumer preferred brand A, what is the probability that he was from Rajshahi?

Example:

An automatic machine fills plastic bags with a mixture of beans, peas and other vegetables. Most of the bags contain the correct weight, but because of the slight variation in the size of the beans and other vegetables, a package might be slightly underweight or overweight. A check of 4000 packages filled in the past month revealed:

Weight	Event	No. of Packages	Prob. of Occurrence
Under weight	A	100	.025
Satisfactory	B	3600	.900
Overweight	C	300	.075
Total		4000	1.000

What is the prob. that a particular package will be either underweight or overweight?

Q3. A die is thrown twice. Each time the number appearing on it is recorded. Describe the following events: A= both numbers are odd. B= both numbers are even. C= sum of the numbers is less than 4. Also, find $A \cup B, A \cap B, A \cup C, A \cap C, A \cup B, A \cap B, A \cup C, A \cap C$. Which pairs of events are mutually exclusive?

Q4. A die is thrown twice. Each time the number appearing on it is recorded. Describe the following events: A= both numbers are odd. B= both numbers are even. C= sum of the numbers is less than 6. Also, find $A \cup B, A \cap B, A \cup C, A \cap C A \cup B, A \cap B, A \cup C, A \cap C$. Which pairs of events are mutually exclusive?

Solution

Let us define the events A, B, C, D as follows:

1) A: an engineer is under 30 years of age.
   B: an engineer is over 40 years of age.
   C: an engineer has bachelor's degree only.
   D: an engineer has a master's degree.

   a) The probability of an engineer who has a bachelor's degree only is given by

$$P(C) = \frac{150}{200} = 0.75.$$

   b) The probability of an engineer who has a master's degree, given that he is over 40 years is

$$P(D / B) = \frac{P(D \cap B)}{P(B)} = \frac{10/200}{50/200} = \frac{10}{50} = 0.20$$

   a) The probability of an engineer who is a under 30 years, given he has only a bachelor's degree is

$$P(A/C) = \frac{P(A \cap C)}{P(C)} = \frac{90/200}{150/200} = \frac{90}{150} = 0.60$$

Example(2)

	Dhaka	Chittagong	Khulna	Rajshahi	Total
Yes	45	55	60	50	210
No	35	45	35	45	160
No opinion	5	5	5	5	20
Total	85	105	100	100	390

Let the even A denote that a consumer selected at random preferred brand A.

(i) $(P(A) = \frac{210}{390} = \frac{7}{13} = 0.5385$

(ii) $(A \cap K) = \frac{60}{390} = \frac{2}{13} = 0.1538$

(iii) $P(A/K) = \frac{P(A \cap K)}{P(K)} = \frac{60/390}{100/390} = \frac{5}{3} = 0.6$

(iv) $P(R/A) = \frac{P(R \cap A)}{P(A)} = \frac{50/390}{210/390} = \frac{5}{21} = 0.238$