# INTRODUCTORY TO PROBABILITY
## Chapter Glossary

**Experiment**: A process with well-defined outcomes that, when performed, results in one and only one of the outcomes per repetition.

**Outcome**: The result of the performance of an experiment.

**Sample Space**: The collection of all sample points or outcomes of an experiment.

**Sample point**: An outcome of an experiment.

**Event**: A collection of one or more outcomes of an experiment.

**Simple Event**: An event that contains one and only one outcome of an experiment. It is also called and elementary event.

**Compound Event**: An event that contains more than one outcome of an experiment. It is also called a composite event.

**Venn Diagram**: A picture that represents a sample space or specific events.

**Tree Diagram**: A diagram in which each outcome of an experiment is represented by a branch of a tree.

**Probability**: A numerical measure of the likelihood that a specific event will occur.

**Classical probability rule**: The method of assigning probabilities to outcomes or events of an experiment with equally likely outcomes.

**Equally likely outcomes**: Two (or more) outcomes or events that have the same probability of occurrence.

**Relative frequency as an approximation of probability**: Probability assigned to an event based on the results of an experiment or based on historical data.

**Subjective probability**: The probability assigned to an event based on the information and judgment of a person.

**Marginal probability**: The probability of one event or characteristic without consideration of any other event.

**Conditional probability**: The probability of an event subject to the condition that another event has already occurred.

**Mutually exclusive event**: Two or more events that do not contain any common outcome and, hence, cannot occur together.

**Independent Events**: Two events for which the occurrence of one does not change the probability of the occurrence of the other.

**Dependent Events**: Two events for which the occurrence of one changes the probability of the occurrence of the other.

**Joint probability**: The probability that two (or more) events occur together.

**Complementary Events**: Two events that taken together include all the outcomes for an experiment but do not contain any common outcome.

**Union of two events**: Given by the outcomes that belong either to one or both events.

**Intersection of events**: The intersection of events is given by the outcomes that are common to two (or more) events.

1. A sample of 400 large companies showed that 130 of them offer free health fitness centers to their employees on the company premises. If one company is selected at random from this sample, what is the probability that this company offers a free health fitness center to its employees on the company premises? What is the probability that this company does not offer a free health fitness center to its employees on the company premises? Do these two probabilities add up to 1.0? If yes, why?
[13/40]
[27/40]
[Yes, because the events are complementary events.]

2. A sample of 820 adults showed that 80 of them had no credit cards, 116 had one card each, 94 had two cards each, 77 had three cards each, 43 had four cards each, and 410 had five or more cards each. Write the frequency distribution table for the number of credit cards and adult possesses. Calculate the relative frequencies for all categories. Suppose one adult is randomly selected from these 820 adults. Find the probability that this adults has
   a. Three credit cards [77/820]
   b. Five or more credit cards [1/2]

3. A small ice cream shop has 10 favors of ice cream and 5 kinds of toppings for its sundaes. How many different selections of one flavor of ice cream and one kind of topping are possible? [50]

4. A restaurant menu has four kinds of soups, eight kinds of main courses, five kinds of desserts, and six kinds of drinks. If a customer randomly selects one item from each of these four categories, how many different outcomes are possible? [960]

5. Two thousand randomly selected adults were asked whether or not they have ever shopped on the Internet. The following table gives a two-way classification of the responses.

| | Have Shopped | Have Never Shopped |
|---|---|---|
| Male | 500 | 700 |
| Female | 300 | 500 |

   a. If one adult is selected at random from these 2000 adults, find the probability that this adult
      i. Has never shopped on the Internet [0.6]
      ii. Is a male [0.6]
      iii. Has shopped on the Internet given that this adult is a female [3/8]
      iv. Is a male given that this adult has never shopped on the Internet. [7/12]

   b. Are the events "male" and "female" mutually exclusive? What about the events "have shopped" and "male"? Why or why not?
   [Yes, because $P(M \cap F) = 0$]
   [No, because $P(S \cap M) \neq 0$]

c. Are the events “female” and “have shopped” independent? Why or why not? [No, because $P(F \cap S) \neq P(F).P(S)$]

6. Find the joint probability of A and B for the following.
   a. P(A) = 0.40 and P(B|A)=0.25
   b. P(B) = 0.65 and P(A|B)=0.36
   c. P(B) = 0.59 and P(A|B)=0.77
   d. P(A) = 0.28 and P(B|A)=0.35

7. Given that P(A) = 0.30 and P(A and B) = 0.24, find P(B|A).

8. Given that P(A|B) = 0.40 and P(A and B) = 0.36, find P(B).

9. Given that P(B|A) =0.80 and P(A and B) = 0.58, find P(A).

10. A consumer agency randomly selected 1700 flights for two major airlines, A and B. The following table gives the two-way classification of these flights based on airline and arrival time. Note that ”less than 30 minutes late” includes flights that arrived early or on time.

| | Less Than 30 Minutes Late | 30 Minutes to 1 Hour Late | More Than 1 Hour Late |
|---|---|---|---|
| Airline A | 429 | 390 | 92 |
| Airline B | 393 | 316 | 80 |

   a. Suppose one flight is selected at random from these 1700 flights. Find the following probabilities.
      i. P(more than 1 hour late and airline A)
      ii. P(airline B and less than 30 minutes late)
   b. Find the joint probability of events “30 minutes to 1 hour late” and “more than 1 hour late.” Is this probability zero? Explain why or why not.