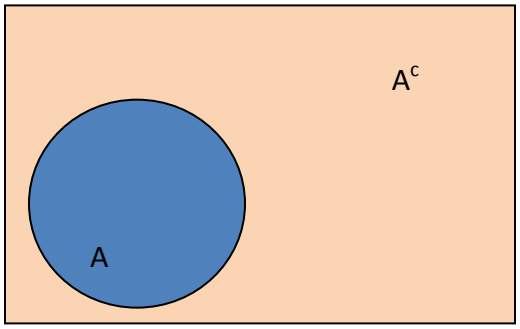
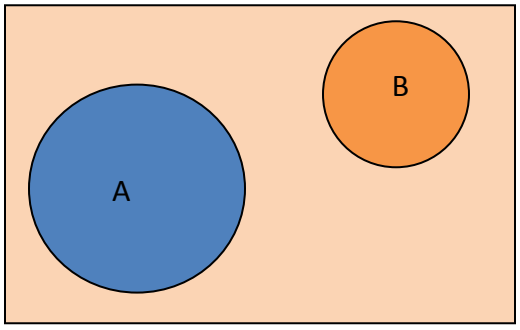
Chapter 14: From Randomness to Probability

The probability of an event is its long-run relative frequency. Probability is defined on the fallowing terms: **Trial,** a single attempt of a random phenomenon; **Outcome**, the value for an individual instance of that trial; **Event**, a collection of outcomes. Any single event will have a chance of occurring or not. Although we may not be able to predict a particular individual outcome, the long-run relative frequency of repeated independent events settles down to the true relative frequency as the number of trails increases. It is important to know that the probability of an event is between 0 and 1. The sum of the probabilities of all the outcomes must be 1.

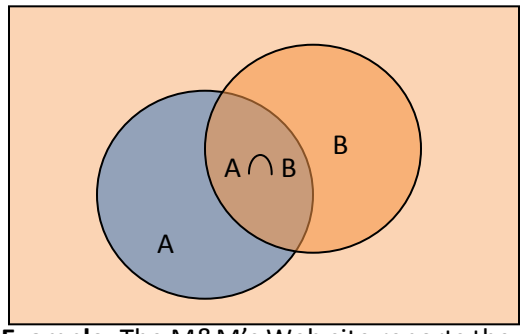


- **Compliment Rule** - The probability of an event occurring is 1 minus the probability that it doesn't occur.

  $P(A)= 1-P(A^c)$



- **Disjoint or mutually exclusive** – events have no outcomes in common.
- **Addition Rule** – For two disjoint events A and B, the probability that one or the other occurs is the sum of the probabilities of the two events.
  P(A U B) = P(A) + P(B), provided that A and B are disjoint.



- **The Multiplication Rule** – for independent events, to find the probability that both events occur, we just multiply the probabilities together.

  P(A ∩ B) = P(A) × P(B), provided that A and B are independent.

Example: The M&M's Web site reports the proportions of Japanese votes by color. These give the probability of selecting a voter who preferred each of the colors: P(pink) = 0.38, P(teal) = 0.36, P(purple) = 0.16, and .10 did not express any opinion.

1. **Addition Rule:** P(pink U teal)= P(pink) + P(teal)
   = 0.38 + 0.36 = 0.74
2. **Multiplication Rule:** P(first respondent picks purple ∩ second respondent picks purple) = P(first respondent picks purple) × P(second respondent picks purple)
   = 0.16 × 0.16 = 0.0256
3. **Compliment Rule:** P(at least one picked purple) = P({none picked purple}^{C})
   = 1 – P(none picked purple)

We have seen the distinguishing feature of random phenomena which allows us to see patterns which would otherwise appear as chaotic happenings.