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Chapter 14: From Randomness to Probability

- The **probability** of an event is its long-run relative frequency.
- A **phenomenon** consists of **trials**. Each **trial** has an **outcome**. **Outcomes** combine to make **events.**
- When talking about series of trials, we want individual trials to be independent, meaning the outcome of one trial does not influence or change the outcome of another.
  *Ex: *If you are driving to work and your friend was driving behind you in another car, you would not be able to include his observations with yours because most of the time, his experience will duplicate yours.*
- **Law of Large Numbers** (LLN) gives us the guarantee that we need. It says that the long-run relative frequency of repeated independent events settles down to the true probability as the number of trials increases.
- How to write probability: If the relative frequency of red lights settles down to 35%, we say that the probability of a red light is 0.35, **P(Red) = 0.35.**
- **"Something Has to Happen Rule:** The probability of the set of all possible outcomes must be 1.
  P(S) = 1. (S represents the set of all possible outcomes.)
- **Complement Rule:** The probability of an event occurring is 1 minus the probability that it does not occur. The set of outcomes that are not in the event **A**, is called the **complement** of **A.**
  *Ex: *Suppose the probability you get to class on time is 0.8. The probability that you do not get to class on time is 0.2.*
- **Addition Rule** states: For two **disjoint** events **or mutually exclusive** (events that have no outcomes in common) A and B, the probability that one or the other occurs is the sum of the probabilities of the two events.
  P(A ∪ B) = P(A) + P(B), provided A and B are disjoint.
  *Ex: *Suppose the probability that a randomly selected student is a sophomore (A) is 0.20, and the probability that he or she is a junior (B) is 0.30. What is the probability that the student is either a sophomore or junior? **P(0.20 + 0.30) = 0.50**.*
- **Multiplication Rule** states: For two independent events A and B, the probability that both A and B occur is the product of the probabilities of the two events.
  P(A ∩ B) = P(A) x P(B), provided that A and B are independent.
  **Ex: Suppose the probability that a light is 35% of the time red and 65% either green or yellow at other times. What is the chance of finding the light red every day this week?*
  ***0.35 x 0.35 x 0.35 x 0.35 x 0.35 = 0.00525**.*
- Things to look out for:
  Disjoint events **CANNOT** be independent.
  Make sure the probabilities add up to 1, if it does not, there is something wrong.
  Do not add probabilities of events if they are not disjoint.
  Do not multiply probabilities of events if they are not independent.

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