

- LO 1.** Define trial, outcome, and sample space.
- LO 2.** Explain why the long-run relative frequency of repeated independent events settle down to the true probability as the number of trials increases, i.e. why the law of large numbers holds.
- LO 3.** Distinguish disjoint (also called mutually exclusive) and independent events.
- If A and B are independent, then having information on A does not tell us anything about B.
 - If A and B are disjoint, then knowing that A occurs tells us that B cannot occur.
 - Disjoint (mutually exclusive) events are always dependent since if one event occurs we know the other one cannot.
- LO 4.** Draw Venn diagrams representing events and their probabilities.
- LO 5.** Define a probability distribution as a list of the possible outcomes with corresponding probabilities that satisfies three rules:
- The outcomes listed must be disjoint.
 - Each probability must be between 0 and 1, inclusive.
 - The probabilities must total 1.
- LO 6.** Define complementary outcomes as mutually exclusive outcomes of the same random process whose probabilities add up to 1.
- If A and B are complementary, $P(A) + P(B) = 1$.
- LO 7.** Distinguish between union of events (A or B) and intersection of events (A and B).
- Calculate the probability of union of events using the (general) addition rule.
 - + If A and B are not mutually exclusive, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$.
 - + If A and B are mutually exclusive, $P(A \text{ or } B) = P(A) + P(B)$, since for mutually exclusive events $P(A \text{ and } B) = 0$.
 - Calculate the probability of intersection of independent events using the multiplication rule.
 - + If A and B are dependent, $P(A \text{ and } B) = P(A) \times P(B|A)$.
 - + If A and B are dependent, independent, $P(A \text{ and } B) = P(A) \times P(B)$, since for independent events $P(B|A) = P(B)$.

* *Reading: Section 2.1 of OpenIntro Statistics*

* *Videos:*

- *Basics of probability, YouTube (1:42)*
- *Union of events and the addition rule, YouTube (3:37)*
- *Independent events, intersection of events, multiplication rule, and Bayes' Theorem, YouTube (3:25)*

* *Test yourself:*

1. *What is the probability of getting a head on the 6th coin flip if in the first 5 flips the coin landed on a head each time?*
2. *True / False: Being right handed and having blue eyes are mutually exclusive events.*

3. $P(A) = 0.5$, $P(B) = 0.6$, there are no other possible outcomes in the sample space. What is $P(A \text{ and } B)$?

LO 8. Distinguish marginal and conditional probabilities.

LO 9. Construct tree diagrams to calculate conditional probabilities and probabilities of intersection of non-independent events using Bayes' theorem.

* *Reading: Section 2.2 of OpenIntro Statistics*

* *Videos:*

– *Probability trees, Dr.Çetinkaya-Rundel (8:23)*

– *Conditional probability, YouTube (8:59 - watch from 3:33 onwards)*

– *Bayes' Theorem worked out example, YouTube, (9:20, somewhat lengthy)*

– *Another example of conditional probabilities using Bayes' Theorem, YouTube (7:20)*

* *Test yourself: 50% of students in a class are social science majors and the rest are not. 70% of the social science students and 40% of the non-social science students are in a relationship. Create a contingency table and a tree diagram summarizing these probabilities. Calculate the percentage of students in this class who are in a relationship.*