

1 Venn Diagram

Out of 1,000 computer science students, 400 belong to a club (and may work part time), 500 work part time (and may belong to a club), and 50 belong to a club and work part time.

- (a) Suppose we choose a student uniformly at random. Let C be the event that the student belongs to a club and P the event that the student works part time. Draw a picture of the sample space Ω and the events C and P .

- (b) What is the probability that the student belongs to a club?

- (c) What is the probability that the student works part time?

- (d) What is the probability that the student belongs to a club AND works part time?

- (e) What is the probability that the student belongs to a club OR works part time?

2 Flippin' Coins

Suppose we have an unbiased coin, with outcomes H and T , with probability of heads $\mathbb{P}[H] = 1/2$ and probability of tails also $\mathbb{P}[T] = 1/2$. Suppose we perform an experiment in which we toss the coin 3 times. An outcome of this experiment is (X_1, X_2, X_3) , where $X_i \in \{H, T\}$.

(a) What is the *sample space* for our experiment?

(b) Which of the following are examples of *events*? Select all that apply.

- $\{(H, H, T), (H, H), (T)\}$
- $\{(T, H, H), (H, T, H), (H, H, T), (H, H, H)\}$
- $\{(T, T, T)\}$
- $\{(T, T, T), (H, H, H)\}$
- $\{(T, H, T), (H, H, T)\}$

(c) What is the complement of the event $\{(H, H, H), (H, H, T), (H, T, H), (H, T, T), (T, T, T)\}$?

(d) Let A be the event that our outcome has 0 heads. Let B be the event that our outcome has exactly 2 heads. What is $A \cup B$?

(e) What is the probability of the outcome (H, H, T) ?

(f) What is the probability of the event that our outcome has exactly two heads?

(g) What is the probability of the event that our outcome has at least one head?

3 Counting & Probability

Consider the equation $x_1 + x_2 + x_3 + x_4 + x_5 + x_6 = 70$, where each x_i is a non-negative integer. We choose one of these solutions uniformly at random.

- (a) What is the size of the sample space?
- (b) What is the probability that both $x_1 \geq 30$ and $x_2 \geq 30$?
- (c) What is the probability that either $x_1 \geq 30$ or $x_2 \geq 30$?