Sample Space: the set of all possible outcomes – denoted as Omega

Example = a commuter passes through 3 intersections, they can stop or continue at each intersection

Omega = { ccc, scc, … }

|Omega| = 8

Example = Count the number of days of rain in Davis in 2025.

Omega = { 0, 1, 2, …, 365 }

Example = We record the amount of time between the next two emails I receive.

Omega = { t in Real Numbers | t > 0 }

Events: subsets of omega

A subset of omega, say A, is written as A subset symbol omega

If w in A, then w in omega

Example = Consider the event that the commuter stops at the first intersection

A = { scc, scs, ssc, sss } = { commuter stops at first intersection }

Example = Consider the event B that rains more than 10 days in 2025

B = { 11, 12, …, 365 }

Basic Set Theory

Union: If A and B are subsets of omega, their union is A U B = { w in Omega: w in A or w in B }

Intersection: A intersect B = { w in Omega: w in A and w in B }

U A\_i = { w in Omega: w in Ai for at least one i = 1, …, n }

Same notation can be used for intersection, with big n instead

The complement of event A is A^c = { w in Omega: w not in A }

If A and B are events, then their set difference is A \ B = { w in Omega: w in A and w not in B }

A \ B = A intersect B^c

Disjoint = events A and B are disjoint if no outcomes belong to both A and B

Empty set is 0 with slash through it = {}

A n B = {}

Example = A = { fewer than 5 days of rain in 2025 }, B = { more than 10 days of rain in 2025 }

A n B = {}

Note = A n A^c = {} for any A

Algebra of set operations

Commutative law:

* A U B = B U A
* A n B = B n A
* For any A, B

Associative law:

* (A U B) U C = A U (B U C)
* (A n B) n C = A n (B n C)
* For any A, B, C

Distributive law:

* (A U B) n C = (A n C) U (B n C)
* (A n B) U C = (A U C) n (B U C) [note: does not work in ordinary arithmetic]

DeMorgan’s Laws

Let A1, …, An be events

(U Ai) ^ c = n Ai^c

(n Ai) ^ c = U Ai^c

Next time = axioms