Modeling of systems and processes

More on Git

- Microsoft's 30 mins Introduction to Git
- GitHub's hands-on training course (< 1 hour) Introduction to GitHub

- tl;dr:
  - `git status`
  - `git pull`
  - `git add .`
  - `git commit -m "<your message here>"`
  - `git push`

Board Question

Deck of 52 cards

- 13 ranks: 2, 3, . . . , 9, 10, J, Q, K, A
- 4 suits: ♥, ♠, ♦, ♣,

Poker hands

- Consists of 5 cards
- A one-pair hand consists of two cards having one rank and the remaining three cards having three other ranks
- Example: { 2♥, 2♠, 5♥, 8♣, K♦ }

Question

(a) How many different 5 card hands have exactly one pair?

Hint: practice with how many 2 card hands have exactly one pair. Hint for hint: use the rule of product.

(b) What is the probability of getting a one pair poker hand?

Probability Cast

Introduced so far

- Experiment: a repeatable procedure
- Sample space: set of all possible outcomes S (or Ω). Event:
- a subset of the sample space.
- Probability function, P(ω): gives the probability for each outcome $\omega \in S$
    1. Probability is between 0 and 1
    2. Total probability of all possible outcomes is 1.

Example

Experiment: toss a fair coin, report heads or tails.

Sample space: $\Omega = \{ H, T \}$.

Probability function: $P(H) = .5$, $P(T) = .5$.

Use tables:

Outcomes	H	T
Probability	1/2	1/2

(Tables can really help in complicated examples)

Discrete sample space

Discrete = listable

Examples:

{a, b, c, d} (finite)

{0, 1, 2, …} (infinite)

Events

Events are sets:

- Can describe in words Can
- describe in notation
- Can describe with Venn diagrams

Experiment: toss a coin 3 times.

Event:

You get 2 or more heads = { HHH, HHT, HTH, THH}

CQ: Events, sets and words

Experiment: toss a coin 3 times.

Which of following equals the event “exactly two heads”?

$A = \{THH, HTH, HHT, HHH\}$

$B = \{THH, HTH, HHT\}$

$C = \{HTH, THH\}$

(1) A (2) B (3) C (4) A or B

CQ: Events, sets and words

Experiment: toss a coin 3 times.

Which of the following describes the event $\{THH, HTH, HHT\}$?

(1) "exactly one head"
(2) "exactly one tail"
(3) "at most one tail"
(4) none of the above

CQ: Events, sets and words

Experiment: toss a coin 3 times.

The events “exactly 2 heads” and “exactly 2 tails” are disjoint.

(1) True (2) False

CQ: Events, sets and words

Experiment: toss a coin 3 times.

The event “at least 2 heads” implies the event “exactly two heads”.

(1) True (2) False

Probability rules in mathematical notation

Sample space: $S = \{\omega_1, \omega_2, \ldots, \omega_n\}$

Outcome: $\omega \in S$

Probability between 0 and 1:

Total probability is 1:

Event A: P(A)

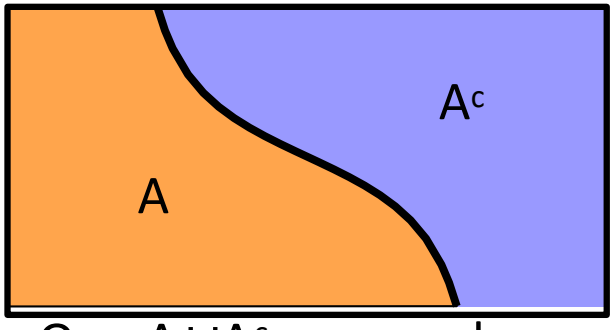
Probability and set operations on events

Events A, L, R

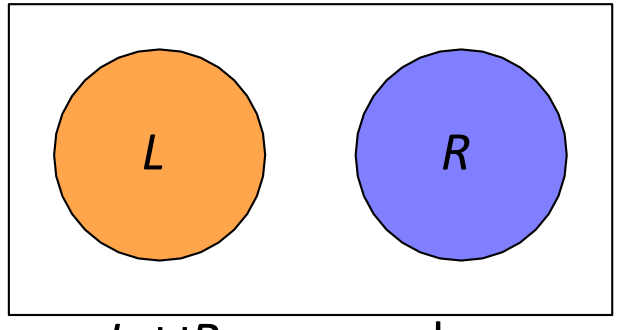
Rule 1. Complements: $P(A^c) = 1 - P(A)$.

Rule 2. Disjoint events: If L and R are disjoint then
$P(L \cup R) = P(L) + P(R)$.

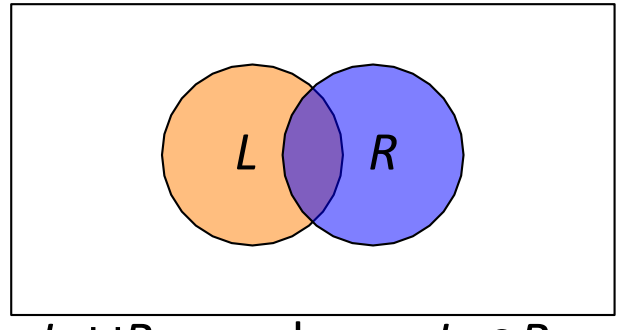
Rule 3. Inclusion-exclusion principle: For any L and R:
$P(L \cup R) = P(L) + P(R) - P(L \cap R)$.



$\Omega = A \cup A^c$, no overlap



$L \cup R$, no overlap



$L \cup R$, overlap = $L \cap R$

References

Dr. Jeremy Orloff. Jonathan Bloom. Introduction to Probability and Statistics. Spring 2014. Massachusetts Institute of Technology: MIT OpenCouseWare, https://ocw.mit.edu/. License: Creative Commons BY-NC-SA.