Day 13 (Review Session)

Problem Solving Methodology

1. What problems look like
2. What info to look for
3. How to solve them

Independent vs. Disjoint

Are A and B Disjoint

Looks like: define two events

Looking for:

- P(A)
- P(B)
- P(A ∩ B)

Check: Is P(A ∩ B) = 0

If yes → disjoint

If no → not disjoint

Are A and B independent

Looking for:

- P(A)
- P(B)
- P(A ∩ B)

Find ONE OF the following comparisons:

Is P(A ∩ B) = P(A)P(B)

If yes → independent

If no → dependent

Is P(B | A) = P(B)?

- P(B|A) = $\frac{P(A \cap B)}{P(A)}$

Event vs Probability

- **Event:** an actual thing that could happen or not
  - Example: the dog will go to the right place
- **Probability:** a number between 0-1 assigned to the "chance" of an event
  - Example: The dog has a 50% chance of going to the right bowl

Example

Problem: 3 lights, independently red/green

If red → 2 minutes

10 minutes to get to work

All green → 8 minutes

P(A) = 0.6 P(B) = 0.4 P(C) = 0.9

A → Light 1 is red B → Light 2 is red C → Light 3 is red

<u>Goal:</u> Find the probability of not being late to work

Employee is not late <u>if:</u>

- all green
- one light is red

P(not late) = P(all green) + P(one red)

all green = $\{(A^c, B^c, C^c)\}$ **he hits no red lights**

one red = $\{(A, B^c, C^c)$, (A^c, B, C^c), $(A^c, B^c, C)\}$ **he hits at most one light**

all green = $\mathrm{P}(\{(A^c, B^c, C^c)\})$

$= \mathrm{P}(A^c)\mathrm{P}(B^c)\mathrm{P}(C^c)$

= (0.4)(0.6)(0.1)

= 0.024

finish from picture

Conditional Probability/Bayes' Rule

Given: two conditional probabilities/proportions $P(B|A), P(B|A^c)$

One unconditional probability/proportions (prevalence/base rate) P(A)

Goal: Find a different conditional probability P(A|B)

P(A|B) = $\frac{P \cap B}{P(B)}$