1/10/17

More on farming insurance:

- System to insure failure crops
  - ↳ sell insurance
    - if Temperature < cutoff
    - then farmer gets $1000 to cover crop loss
  - → Insurer has to estimate the probability of this weather condition occurring

- Same idea with insurance against hurricanes or with health insuran

- There's a lot of uncertainty in life
- Most cause and effect relationships are uncertain
- Most uncertainty stems from:
  - → lack of information
  - → lack of technology
  - → inaccuracy of measurement (error)
    - ↳ Heisenberg Uncertainty principle says it's impossible to measure velocity & position of small particles at same time

Uncertain knowledge	+	Knowledge of extent of uncertainty	=	Useable Knowledge

2 kinds of statements

① It will rain (not rain) tomorrow → Less information

② There is X% chance of rain tomorrow → More refined information, includes uncertainty

#2 can help imply #1 but not vice versa

Common Terms

randomness
chance
variability
expectation
distribution
standard error

- All of these are related to uncertainty

- Probability is the tool used for inferential statistics

- Branches of statistics
  - inferential statistics → infer about population from sample
  - descriptive statistics → obtain summary of data (e.g. mean, variance)

Ex. Throw 10 coins

Results:	H	H	T	T	H	T	T	T	T	T
	1	2	3	4	5	6	7	8	9	10

- Look like probability of heads is 3/10
  - ↳ But you can't conclude that coin is unfair. Sample size is too small for certainty

- Assumed a model for this data
  - ↳ Bernoulli distribution
    - ↳ says value 1 (H) with p
      value 0 (T) with 1−p $0 < p < 1$

- Need to learn distributions and probabilistic models to apply the appropriate one to real data

* Probability preliminaries
* Discrete, continuous probabilistic models
* Multivariate probabilistic model
* Large sample methods

Preliminaries of Probability

- Topics: sample spaces
  events (= sets)
  operations on events ($\cup, \cap$)

- Experiments can be done in reality or by logic on paper

- Process counting, enumerating (listing all the possible outcomes)

Sample space: The set of all possible outcomes of an experiment
∴ Will be denoted S

↳ For coin flip example $S = \{H, T\}$
↳ dice throw → $S = \{1, 2, 3, 4, 5, 6\}$
↳ 2 dice throw → $S = \{(1,1)(1,2)(1,3)\ldots(6,6)\}$ → 36 results
↳ consider (3,1) ≠ (1,3) as different results

↳ Select 2 fuses & classify as either defective (D) or non defective (N)
$S = \{DN, NN, ND, DD\}$
↳ Sample space of how many are defective?
$S = \{0, 1, 2\}$

↳ Sample space of the number of fuses inspected until two defective fuses are found
$S = \{2 \ldots 10 \ldots 20 \ldots 200 \ldots\}$