Introduction

WELCOME TO CLASS.
YOU MAY START THINKING NOW.

Today's Class

o Why study probability and statistics?

o Uncertainty
- Why do we need to make decisions under uncertainty?

o Understand how probability and statistics can support better decision making
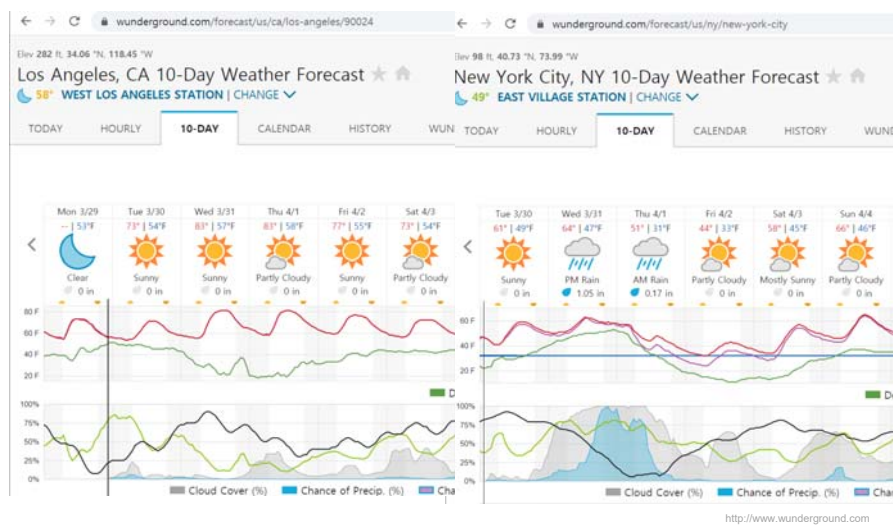
Why study probability and statistics?

"It is in your moments of decision that your destiny is shaped." – Tony Robbins

- What makes decisions hard?
- Probability and statistics are the language of uncertainty
- We are able to explicitly include uncertainty into decision making using probability
- Statistics provide data about uncertain relationships

Chance of Rain

How do you make your decision under uncertainty?

Average
Depth
3 ft

http://www.danzigercartoons.com/

Uncertainty

"The only certainty is that nothing is certain"

- Pliny the Elder

Uncertainty

- Uncertainty are associated with
  - Natural randomness
  - Inaccuracies in our prediction and estimation of reality
- Measurements are variable
  - Random error
  - Systematic error

What do we do when faced with uncertainty?

- How do you design a policy for climate change?
- How do you design a culvert for flood prevention?
  - Plan for the "worst case"?
  - Plan for the "average case?"

What kind of engineering decisions involve uncertainty?

- Designing a bridge
  - Earthquakes
  - Safety standards
  - Costs
  - Materials
- Designing water supply
  - Future climate conditions
  - Future population
- Supply chain management
  - Future demand
  - Hurricanes and other disruptions
- Designing a wind turbine
  - Wind conditions
  - Materials

What is Probability?

- One thing that makes decisions hard is *uncertainty*
- *Uncertainty* can be assessed or discussed informally using language such as "it is unlikely" or "probably"
- *Probability* is the mathematical language of uncertainty

Probability in Daily Life

- Weather forecasting
- Lottery
- Betting
- Batting averages
- Struck by lightning?

What is Statistics?

- Statistics are numbers that summarize the results of a study
- *Statistical inference* formalizes the process of *learning through observation*
- Statistics is the field that studies how to efficiently collect informative data, explore and interpret these data and draw conclusions based on them

Statistics in Daily Life

- Weather Forecasts
- Emergency Preparedness
- Predicting Disease
- Medical Studies
- Genetics
- Political CampaignsInsurance
- Consumer Goods
- Quality Testing
- Stock Market

The Most Famous Quote:

"There are three kinds of lies:
- Lies
- Damned lies
- Statistics"

Question

○ Which city is warmer?