Week 11

Introduction to Data Analysis for Physics

New Textbook Sections

http://www.cs.utexas.edu/~evanott/PHY110C_Textbook/static/data_analysis/Analysis/gaussian.html#combining-distributions

http://www.cs.utexas.edu/~evanott/PHY110C_Textbook/static/data_analysis/Math/stats.html

Probability!

- Chance, random variables, sample space
- Notation
  - P(X)
  - P(AB)=P(A&B)=P(A ^ B)
  - P(A v B)=P(A+B)
  - P(A|B)
- Independence
  - True iff P(A|B)=P(A)
  - Alternately, that P(AB)=P(A)P(B)

Probability Distributions

- Assign probability to each possible outcome
- Expected value is average of outcomes' values weighted by probability of outcome:
  - <f>=f1*P(1)+f2*P(2)+...
  - <f> need not be a possible single outcome
- Simple models: coins, dice

Sidebar: Combining Distributions

Analysis/gaussian.html#combining-distributions

We'll need to be able to combine distributions shortly.

Flip It, Flip It Good

- Take a penny, flip 6 times, record the sequence:
  - e.g., HTTHHH
- If coins are fair, what is the expected number of heads?
- What are the odds of getting your particular sequence?
- In groups of 3 people, what's the average number of heads? The standard deviation of your sample?
- Report group values AND first two flips to Evan

Coin Results

Mean	Std. Dev
3	.82
1.75	1.8
4.67	.59
3	0.36
3.5	0.2

Coin Results

First \ Second	H	T
H	4->.267	2->.133
T	5->.333	4->.267

Significance

- Are our results strange? How strange can they be before we call the Mint?
- Use a Gaussian model to look at statistical significance.
- z-scores, p-values, confidence intervals: next week!

Reviewing our Data

- (Cheating and using topics of future past)
- In binary case, mean is Np, variance is Np(1-p)
- Apply to your sample. How many standard deviations are you away?
- For class sample, do we need to call the Mint?

Extra: OpenIntro

http://www.openintro.org/stat/slides.php