BIOEN 3070/5070: Introduction to Statistics for Bioengineers

- Fall 2012
- Tuesdays and Thursdays 12:25–1:45pm at WEB 2.208

- TA Office Hours
  Abhijit Mondal: Fridays and Wednesdays 9:00–11:00am at MEB 2475
  Salil N. Pendse: Tuesdays at MEB 1225 and Thursdays at 1450 2:00–4:00pm
  P. J. Maresca: Tuesdays and Thursdays 10:00am–12:00noon at MEB 2475

- Staff meetings Thursdays 4:00–5:00pm

  What additional skills will we gain and how will we do it?

  100% Grade = 60% Assignments, 30% Quizes, 10% Class Participation

- The textbook is available at the library, and is on reserve.

- Download a Mathematica license for your laptop for as low as $44.95, or get a trial version.

- Additional Textbooks:
  - Introduction to Probability, by J. E. Freund (Dover, 1973).

- Tutoring

- Important Dates

- Safety

- Health and Wellness

- Code of Student's Rights and Responsibilities

Aug 21:
  International Conference on Stochastic Processes in Systems Biology, Genetics and Evolution (Houston, TX, August 21–25, 2012)

Aug 23:
  Welcome!
Aug 28:
Combinatorics: Counting Subsets and Permutations with Factorials and Binomial Coefficients

Genome Rearrangements:
- Bacteriophage lambda, a bacterial virus, has a double-stranded circular DNA genome, containing roughly 65 genes. How many possibilities are there to arrange the genes into the circular genome?
- **Human chromosome 2**, the second largest human chromosome, contains roughly 2,000 protein-encoding genes. There is evidence that this human chromosome arose from the fusion of two ancestral ape chromosomes, homologous to chromosomes 2A and 2B in the chimpanzee with roughly 1,000 genes each. How many possibilities are there to arrange two groups of 1,000 genes into a chromosome of 2,000 genes?

**P vs. NP Problems** from the Clay Institute
[The Millennium Prize Problems](http://www.claymath.org/millennium-problems) from the Clay Institute

Assignment 1: Combinatorics
Due In-Class Sept 4

Aug 30:
Introduction to Mathematica

Sept 4:
From Combinatorics to Probability: The Law of Addition and the Law of Multiplication

**Mendel's Laws of Heredity**: Statistics Predicts the Existence of Chromosomes
From M. G. Bulmer (Dover, 1979), pp. 22–25.

Assignment 2: Probabilities
Due In-Class Sept 13

Sept 6:
From Combinatorics to Distributions: Deriving the Hypergeometric Distribution
[The Hypergeometric Distribution](http://mathworld.wolfram.com/HypergeometricDistribution.html) from Mathworld

Sept 11:
The *P*-Value

[High-Throughput Biotechnologies](http://www.alterlab.org/teaching/BIOEN3070/)
Assessing Significance in Large-Scale Molecular Biological Data:
Sept 13:
   Working with Databases: The Stanford Microarray Database

Assignment 3: **The P-Value and the Hypergeometric Distribution**
Download to your desktop the executable Mathematica 8.0 code: Assignment_3.nb
Due In-Class Feb 20

Sept 18:
   Expectations and Moments of Probability Distributions

Sept 20:
   Preparation for Quiz 1

Sept 25:
   Quiz 1

Sept 27:
   The Binomial Distribution

Assignment 4: **Simulations of the Binomial Distribution**
Download to your desktop the executable Mathematica 8.0 code: Assignment_4.nb
Due In-Class Oct 4

Oct 2:
   The Poisson Distribution

Oct 4:
   The Luria–Delbrück Experiment: The Statistics of Genetic Mutations
   - **Paper 3**: *Mutations of Bacteria from Virus Sensitivity to Virus Resistance*, by S. E. Luria and M. Delbrück (Genetics, 1943).
   - The Nobel Prize in Physiology or Medicine 1969 Max Delbrück, Alfred D. Hershey, Salvador E. Luria

Assignment 5: **The Poisson Distribution and the Statistics of Genetic Mutations**
Due In-Class Oct 18

Oct 9:
   Happy Fall Break!

Oct 11:
   Happy Fall Break!

Oct 16:
   Normal Distribution

Oct 18:
Random Walk

Oct 23:
Brownian Motion: The statistics of Diffusion
- The Nobel Prize in Physics 1921 Albert Einstein

Oct 25:
2012 Biomedical Engineering Society (BMES) Fall Meeting (Atlanta, GA, October 24–27, 2012)

Oct 30:

Nov 1:
Preparation for Quiz 2

Nov 6:
Quiz 2

Nov 8:

Nov 13:
2012 Technion Matrix Theory conference (Haifa, Israel, November 13–15, 2012)

Nov 15:
2012 Technion Matrix Theory conference (Haifa, Israel, November 13–15, 2012)

Nov 20:

Nov 22:
Happy Thanksgiving!

Nov 27:

Nov 29:

Dec 4:

Dec 6:
End-of-Class Celebration!

Happy Winter Break!!!
See you in Spring 2013 in BIOEN 6670-1: Genomic Signal Processing