

Here are some of the topics discussed so far:

General Theory

- probability (three properties)
- conditional probability: $P(A | B) = P(A \cap B)/P(B)$ for $P(B) \neq 0$
- inclusion-exclusion principle: $P(A \cup B) = P(A) + P(B) - P(A \cap B)$, etc.
- multiplication rule: $P(A \cap B) = P(B)P(A | B)$
- independent events
- Bayes' theorem
- random variables
 - one random variable:
 - probability mass/density function (p.m.f./p.d.f.)
 - (cumulative) distribution
 - histogram, bar graph
 - two or more random variables:
 - joint p.m.f./p.d.f.
 - marginals
 - independence
 - correlation coefficient
 - distribution of a conditional RV, $Y|x$
- expected value:
 - $E(u(X)) = \sum_{x \in S} u(x)f(x)$, respectively $E(u(X)) = \int_{-\infty}^{\infty} u(x)f(x) dx$
- mean, variance, standard deviation for the population, and a sample
- Moment generating function (m.g.f.): $M_X(t) = E(e^{tX})$
Its connection with the p.m.f./p.d.f., and the moments of X .
- methods of enumeration (§2.2)
- mean, variance and m.g.f. for sums of independent RV's (in particular: sums of normal, chi-square, Poisson, etc.)
- the Central Limit Theorem, approximations using CLT

Distributions

For each of the distributions, there is a formula for the p.m.f./p.d.f., and maybe also for the mean, variance, or m.g.f. There are also natural connections between these RV's.

- Discrete:
 - uniform
 - hypergeometric
 - binomial (& Bernoulli trials)
 - negative binomial (and geometric)
 - Poisson
- Continuous:
 - uniform
 - Gamma (and exponential, chi-square)
 - normal (and relation of chi-square to normal)