In-class Exam 1 Review List
18.05, Spring 2022

List of topics

1. Sets.
2. Counting.
3. Sample space, outcome, event, probability function.
4. Probability: conditional probability, independence, Bayes' theorem.
5. Discrete random variables: events, pmf, cdf.
6. Bernoulli(p), binomial(n, p), geometric(p), uniform(n)
7. $E[X]$, Var(X), σ
8. Continuous random variables: pdf, cdf.
9. uniform(a,b), exponential(λ), normal(μ,σ^2)
10. Transforming random variables.
11. Quantiles.
12. Central limit theorem, law of large numbers, histograms.
13. Joint distributions: pmf, pdf, cdf, covariance and correlation.

0.1 Sets and counting

- Sets:
  $\emptyset$, union, intersection, complement Venn diagrams, products
- Counting:
  inclusion-exclusion, rule of product,
  permutations ${}_nP_k$, combinations ${}_nC_k = \binom{n}{k}$

0.2 Probability

- Sample space, outcome, event, probability function. Rule: $P(A \cup B) = P(A) + P(B) - P(A \cap B)$.
  Special case: $P(A^c) = 1 - P(A)$
  (A and B disjoint $\Rightarrow P(A \cup B) = P(A) + P(B)$.)
- Conditional probability, multiplication rule, trees, law of total probability, independence
- Bayes' theorem, base rate fallacy

0.3 Random variables, expectation and variance

- Discrete random variables: events, pmf, cdf
- Bernoulli(p), binomial(n, p), geometric(p), uniform(n)
- $E[X]$, meaning, algebraic properties, $E[h(X)]$
- Var(X), meaning, algebraic properties
- Continuous random variables: pdf, cdf
- uniform(a,b), exponential(λ), normal(μ,σ)
- Transforming random variables
- Quantiles

0.4 Central limit theorem

- Law of large numbers averages and histograms
- Central limit theorem

0.5 Joint distributions

- Joint pmf, pdf, cdf.
- Marginal pmf, pdf, cdf
- Independence
- Covariance and correlation.

18.05 Introduction to Probability and Statistics
Spring 2022