Crib 14 : Distributions

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The crib sheet contains cheat-sheet worthy information but is not a substitute for lectures or for reading the notes. It also contains pointers and common mistakes.

- In the probability section, we outline a few common distributions. It is key that you learn how to identify each of these distributions, to simplify your calculations. We list each distribution we've learned so far and the question it addresses, along with commonly-used properties.
- **Binomial Distribution**

  In n trials, where each independent trial has probability p of success, what is the probability of k successes?

  - Parameters:
    - n - number of trials
    - p - probability of success for a given trial
  - Probability (of k successes): $\binom{n}{k}p^k(1-p)^{n-k}$
  - Mean: np
  - Variance: $np(1-p)$
- **Geometric Distribution**

  If an independent trial has probability p of success, how many more trials until the first success?

  - Parameters:
    - p - probability of success for a given, independent trial
  - Probability (of k trials): $(1-p)^{k-1}p$
  - Mean: $\frac{1}{p}$
  - Variance: $\frac{1-p}{p^2}$

- **Poisson Distribution**

  If there are many trials and our average of successes per unit time, space etc. is λ, what is the probability of k successes per unit time, space etc.?

  Note that this is the binomial distribution as $n \to \infty$; this approximation in general holds when $n \geq 100$ and $p \leq 0.01$.

  - Parameters:
    - λ - average per unit time, space etc.
  - Probability (of k successes): $\frac{\lambda^k}{k!}e^{-\lambda}$
  - Mean: λ
  - Variance: λ