Stat 230: Probability
Lecture 11

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Review

Last time we talked about:

(1) Common distributions
- Hypergeometric Distribution
- Binomial Distribution

For today:

(1) Midterm Review
(2) Common distributions
- Binomial Distribution
- Negative Binomial Distribution

Review

- Reminder: Exam on Tuesday
- TA review tutorial on Monday
- Midterm Review
  - Chapters 1 - 4

Binomial

Example

Your classmate is terrible at coding and has at least one program breaking bug in all his codes with probability 0.6. If he writes 10 pieces of code, what is the probability more than two codes are broken?

Theorem (Binomial approximation to the hypergeometric distribution)

If r and N are large, n is not too large, and $r/N = p$ where $p \in [0,1]$, then if $X \sim hyp(N, r, n)$, and $Y \sim Binomial(n, p)$, then

$$P(X = k) \approx P(Y = k)$$

The approximation is good if N and r are large compared to n.

Binomial

Example

In Overwatch there are 31 playable characters, of which 8 are considered "Tanks". Suppose three characters are drawn at random.

(1) Give the probability the selection contains exactly 2 tanks

(2) Approximate this probability using a binomial approximation

Negative Binomial

Definition

*Consider an experiment in which Bernoulli trials are independently performed, each with probability of success p, until exactly k successes are observed. Then if X denotes the number of failures before observing k successes, we say that X is **Negative Binomial** with parameters k and p.*

$$X \sim NB(k, p)$$

Negative Binomial

Notable differences between the negative binomial and binomial are:

- The Binomial has a fixed number of trials vs. the Negative Binomial has an indefinite number of trials
- The Binomial counts successes while the negative binomial counts failures.