SU DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE
SYLLABUS (Tentative)
MATH 105 *Liberal Arts Mathematics: Statistics through Baseball*

**Objective:** In general, to introduce students to the role of mathematics in culture. Specifically in this offering, to introduce students to the concepts of probability and statistics by means of playing with baseball statistics.

**Intended for**: Students whose major areas of study do not have specific requirements in mathematics, who want to learn elementary probability and statistics, and who have an interest in baseball.

**Prerequisite:** Three years of high-school mathematics, including geometry, or intermediate algebra at a college (MATH 100).

**Text:** *Teaching Statistics Using Baseball*, by Jim Albert; The Mathematical Association of America, 2003.

**Reference:** A book of statistical formulas. My preferred one is *A First Course in Statistics* (any edition), by McClave and Sincich (Prentice Hall). Less valuable but acceptable is *CliffsQuickReview Statistics*, by Voelker, Orton, and Adams (Wiley Publishing, 2001).

| **Topic** | **Weeks** |
|---|---|
| ***An Introduction to Baseball Statistics*** | 2 |
| Mathematical preliminaries: sets and functions. Probabilistic preliminaries: frequency- and probability-distributions. Statistical preliminaries: populations and samples, physical and statistical. Baseball preliminaries: basic measures of performance, and their relation to common statistical measures. | |
| ***Exploring a Single Batch of Baseball Data*** | 2 |
| Teams' offensive statistics: stem-and-leaf displays and the Five-Number Summary. A tribute to Cal Ripken: dotplots, time-series plots, and curve-fitting. A tribute to Roger Clemens: summary statistics and comparison of distributions. Analyzing baseball attendance: histograms. The use of sacrifice-bunts: more comparing of distributions. | |
| ***Comparing Batches and Standardization*** | 1 |
| "Slugging percentages are normal": normal probability distributions. Great batting averages and standardized scores. | |
| ***Introduction to Probability Using Tabletop Games*** | 2 |
| "What is Barry Bonds's home-run probability?": the relative-frequency interpretation of probability and the Law of Large Numbers. Big-league baseball: sample spaces, equiprobable outcomes. All-Star baseball: probability as area, multinomial experiments. Strat-O-Matic Baseball: theorems of probability; conditional probability. | |
| ***Probability Distributions and Baseball*** | 2 |
| Binomial distributions and hits per game: binomial probabilities, independence, expected counts, and simulation. Modeling runs scored: Negative-binomial distributions and Pearson Residuals. | |
| ***Introduction to Statistical Inference*** | 2 |
| Ability and performance. Simulating a batter's performance: Bernoulli Trials, Bayes's Rule. Interval-estimates for ability: confidence-intervals; subjective probability. Comparing Wade Boggs and Tony Gwynn: confidence-interval estimates for proportions, time-series plots. | |
| ***Topics in Statistical Inference*** | 2 |
| Observed situational effects for many players. Modeling batting averages for many players: Normal distributions. | |
| ***Optional topics, as time permits*** | 1 |
| Relationships between sets of measurements. A new measure of offensive performance. Are batting slumps inevitable? Are seven-game playoff series fairer than five-game ones? Modeling baseball with Markov Chains. "Baseball," a Public Broadcasting Service video series. | 14 |

**EVALUATION**

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| Homework and class-participation | 30 - 70% |
| Midterm Examination | 0 - 20% |
| Project | 30 - 70% |
| Final Examination | 0 - 20% |