# BASEBALL AS THE FOCUS FOR A GENERAL EDUCATION MATHEMATICS COURSE

Fred Worth
Henderson State University
Box 7783
1100 Henderson St.
Arkadelphia AR 71999-0001
worthf@hsu.edu

"Correct thinkers think that "baseball trivia" is an oxymoron: Nothing about baseball is trivial." - - - George Will

"There have been only authentic two geniuses in the world. Willie Mays and Willie Shakespeare." - - - Tallulah Bankhead

In the never ending effort to present material in a way that our students will find appealing, I have begun to develop liberal arts mathematics course with baseball as its focus. I am assuming nothing beyond intermediate algebra. As a tool for doing some of the statistics inherent in the topic, I plan to require a graphing calculator, though not necessarily any previous experience with one.

The intention is to teach "useful mathematics" with a focus on baseball that can motivate the mathophobe. Suggestions have been made that the course be expanded to include other sports. That may or may not happen.

**Basic Probability And Statistics**

The first, and most natural topic for consideration is basic statistics. In baseball, almost all statistics fall in 3 basic categories. The first is simple counting. Things like at bats, hits, runs, etc. are all just counted. Second are basic percentages, like batting average, slugging percentage, etc. Earned run average, walks/hits per 9 innings and similar statistics are themselves percentages but are based on a base of 9, rather than 100 so they are a natural place to look at rates and conversions.

The last category, for lack of a better name, is "other." Things like games behind, OPS, runs created above average, and win shares, are sufficiently baseball specific that there are not a lot of practical "real-world" uses for them. They will be discussed but in a limited way.

Some simple statistical analysis will be discussed. For example, we can look at how baseball teams may use statistics. We can discuss leaders, on both the season and career ranks.

Additionally, we will discuss the history of statistics in both a baseball and mathematical context. Regarding baseball, we can discuss changes in rules, changes in style of play over time and how the save statistic has caused a change in how the game is played.

Inherent in any study of statistics is a discussion on how to represent and analyze statistics. We will look at interpretation and construction of ways of representing statistics, such as tables, binned data, bar graphs, time

series plots, pie charts, etc. We will discuss correlation as well.

Since percentages can often be viewed as probabilities, we will discuss probabilities such as the probability that a .250 hitter will get a hit in a given at bat. We can also talk about "hot hitters" and "slumping hitters" and try to decide if such things really exist or if they are instead simple statistical variation.

We will touch on the science of recording data by actually going to a game or two and discussing the ideas of scoring games. Then we can take the data we accumulate and do some tallying of those statistics. We will discuss some very basic programming, using Excel to set up tables for batting, pitching and fielding records.

Lastly we can discuss misleading statistics. For example, "averaging averages" does not work, necessarily, since averages are weighted due to the number of data points under consideration. Thus, a player with a higher average in each half of the season can end up with a lower batting average for the entire season.

**Physics And Modeling**

Various sets of data can be modeled using linear or exponential models. Things like player salaries, ticket prices, concessions and attendance lend themselves well to such efforts.

Certain baseball facts are given in ways that are not particularly appropriate. For example, we talk about the speed of a pitch in miles per hour. For practical use, it makes a lot of sense to look at converting that to feet per second. A player's speed doesn't make sense if we are talking about a 40 yard dash time but a 90 foot dash makes a lot of sense in a baseball context. Therefore we will look at various conversions.

We will discuss one and two dimensional projectile motion. In order to do that we will have to deal with quadratic functions and a minimal amount of trigonometry. We will also discuss other physics concept like bounce and force. Details will be omitted in most cases due to the desire to keep this as a general education course.

**Geometry**

We will discuss a little bit of geometry within the context of areas and perimeters. For example, we can use Heron's formula along with a sequence of triangles to approximate the area of the playing fields in the various baseball stadiums. Similarly, we can approximate perimeters of the fields and the size of foul territory. We will also discuss the Pythagorean Theorem for things like the distance of the catcher's throw to second base.

**Resources**

There is no textbook that I have been able to find for such a course. However, there are numerous books with ideas and data we can use. These would include Teaching Statistics Using Baseball, Curve Balls, Baseball's All-Time Best Hitters, The Physics of Baseball, The Joy of Keeping Score, The Numbers Game, The Book of Baseball Records, Take Me Out to the Ballpark, The Baseball Encyclopedia, and Total Baseball. These are just a start. There are literally hundreds of other worthwhile resources.

Additionally, there are a number of web resources available to aid in the construction of this course. The

following is just a partial list.

http://baseball-reference.com/
http://baseball-almanac.com/
http://www.retrosheet.org/
http://mlb.mlb.com/NASApp/mlb/index.jsp
http://www.baseballprospectus.com/
http://www.baseballprimer.com/
http://www.baseballstuff.com/
http://www.geocities.com/tmasc/
http://knology.net/~johnfjarvis/baseball.html
http://www.robneyer.com/
http://www.geocities.com/Colosseum/Stadium/8957/index.htm
http://www.geocities.com/thestatlink/
http://www.ballparksofbaseball.com/

As mentioned above, we will use Excel to do some statistical work. Additionally we will use the Sabermetric Baseball Encyclopedia (http://baseball-encyclopedia.com/).

**Summary**

While being fun, this course will hopefully help students to learn mathematics. The focus will not only be on baseball. The game of baseball will give a motivation for a topic that we can then look at in the context of other mathematical applications. The hope is that looking at mathematics through the prism of an enjoyable pastime will help students learn and enjoy things that they too often dread.