

Analyzing Numerical Data: Indices Using Weighted Sums and Averages

I.C Student Activity Sheet 7: Slugging Averages

One example of a *weighted average* in sports is a batter's *slugging average* (or *percentage*) in baseball. The slugging average (*SLG*) is calculated using the following equation:

$$SLG = \frac{(1 \cdot S) + (2 \cdot D) + (3 \cdot T) + (4 \cdot HR)}{AB}$$

where *S* = singles, *D* = doubles, *T* = triples, *HR* = home runs, and *AB* = total at-bats.

Each single has a weight of 1, each double a weight of 2, each triple a weight of 3, and each home run a weight of 4. An at-bat without a hit has a weight of 0.

In his first season with the New York Yankees, Babe Ruth set a record for slugging average that stood for more than 80 years. In 1920, Ruth pounded 172 hits in 458 at-bats. His hits consisted of 73 singles, 36 doubles, 9 triples, and 54 home runs, resulting in a total base count of $(73 \cdot 1) + (36 \cdot 2) + (9 \cdot 3) + (54 \cdot 4) = 388$. When his total number of bases (388) is divided by his total at-bats (458), the result is .847, his slugging percentage for the season. This record was broken in 2001 by Barry Bonds, who had 411 total bases in 476 at-bats for a slugging average of .863. (Statistics from www.baseball-almanac.com)

1. Find the slugging average for a player with the following statistics:

$$\begin{aligned} S &= 68 \\ D &= 40 \\ T &= 4 \\ HR &= 16 \\ AB &= 320 \end{aligned}$$

2. **REFLECTION:** Is it possible to have a slugging average of more than 1?

Theoretically, what is the highest possible value for the slugging average? Could a player ever achieve this value during a baseball season? Give an example or explain why none exist.

3. A slugging average of .500 or higher is considered a sign of an excellent player. Suppose a player had 4 triples and a batting average of .300 in 400 at-bats (batting average = hits/at-bats). Determine a combination of singles, doubles, and home runs that gives this player a slugging average higher than .500.

Still using 400 at-bats, what is the maximum number of singles this player could have with a slugging average between .500 and .700? Justify your answer.

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I.C Student Activity Sheet 8: Quarterback Ratings

The National Football League (NFL) rates quarterbacks for statistical purposes against a fixed performance standard based on the statistical achievements of all qualified pro passers since 1960. This system allows passing performances to be compared from one season to the next.

The following categories are used to compute the quarterback rating:

- percent of completions per attempt (**%COMP**)
- percent of touchdown passes per attempt (**%TD**)
- percent of interceptions per attempt (**%INT**)
- average yards gained per attempt (**YD**)

(From www.nfl.com/help/quarterbackratingformula)

The following is the formula for compiling the quarterback rating (**QR**):

$$QR = \frac{25 + 10(\%COMP) + 40(\%TD) - 50(\%INT) + 50(YD)}{12}$$

(**Note:** This formula is subject to a few conditions discussed after Question 2.)

1. For the first two games of the 2008 season, Dallas Cowboys quarterback Tony Romo completed 45 passes in 62 attempts for a total of 632 yards, with 4 touchdowns and 2 interceptions. Verify that Romo's quarterback rating for those games is approximately 113. Round each value to the nearest tenth.

Percent of completions per attempt (**%COMP**) =

Percent of touchdown passes per attempt (**%TD**) =

Percent of interceptions per attempt (**%INT**) =

Average yards gained per attempt (**YD**) =

2. As of 2009, Steve Young has the highest career quarterback rating in NFL history. He completed 2,059 passes in 3,192 attempts for a total of 25,479 yards, with 174 touchdowns and 85 interceptions. Find Young's career quarterback rating.