Name: Date:

***NUMB3RS* Activity: “Choosing Contenders”**

In “Contenders,” the FBI asks Charlie and Amita to look at the official league rankings of each fighter and compare them with their own “rankings” which they created using the skill levels and past performances of each fighter. They find that one fighter has had an easy path all the way to the championship. It seems that someone has arranged the fights so this fighter is always up against opponents who are weaker than he is. In this activity, you will use two “rankings”—the strength of schedule and the power value—to determine a rating for each team of the National Football Conference (NFC) of the National Football League for the 2006 season and use this rating to predict which teams will contend for the NFC Championship.

The values of the two variables, the strength of schedule (*SOS*) and the power value (*PV*), are given for each of the sixteen teams in the NFC before the start of the 2006 season. For a given team, the *SOS* is the average of all the opponents’ winning percentages in the 2005 season, and the *PV* is a rating that combines such statistics as offense yards gained, defense yards allowed, points scored, points allowed, win-loss record, etc. A lower *PV* indicates a stronger team. How can the values of these two variables be used to predict the NFC champion?

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|  | **Carolina** | **Seattle** | **Washington** | **NY Giants** |
| **Strength of Schedule (*SOS*)** | .504 | .457 | .516 | .543 |
| **Power Value (*PV*)** | 11.78 | 12.11 | 13.53 | 13.83 |

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|  | **Dallas** | **Green Bay** | **Atlanta** | **Chicago** |
| **Strength of Schedule (*SOS*)** | .504 | .449 | .508 | .445 |
| **Power Value (*PV*)** | 14.51 | 16.23 | 17.12 | 17.19 |

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|  | **Arizona** | **Tampa Bay** | **Philadelphia** | **New Orleans** |
| **Strength of Schedule (*SOS*)** | .500 | .539 | .520 | .539 |
| **Power Value (*PV*)** | 17.41 | 17.58 | 17.60 | 19.48 |

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|  | **St. Louis** | **Minnesota** | **Detroit** | **San Francisco** |
| **Strength of Schedule (*SOS*)** | .508 | .457 | .473 | .477 |
| **Power Value (*PV*)** | 20.96 | 21.80 | 23.52 | 27.66 |

Strength of Schedule source: [**http://www.fantasytailgate.com/SOS.html**](http://www.fantasytailgate.com/SOS.html)

Power value source: [**http://www.fanbay.net/nfl/projected/2005/power2005-2006.htm**](http://www.fanbay.net/nfl/projected/2005/power2005-2006.htm)

1. Why are lower values of *SOS* better than higher values?
2. Suppose you decide to add the values of the two variables, *SOS* and *PV*, to determine the team rating. Why is this method of finding a rating likely to be ineffective?

Because these variables have different scales, one way to “equalize the variables” is to transform the data in each set, so the mean of each transformed set of data is 1. Multiplying each *SOS* value by the reciprocal of mean(*SOS*) = 1/mean(*SOS*) gives a transformed strength of schedule (*TSOS*) with a mean of 1.

1. **a.** Using your calculator, enter the original *SOS* data in a list, L1. Multiply this list by the reciprocal of the mean of L1 to create another list, L2, for transformed data set *TSOS*. Verify that the mean of *TSOS* is 1. (To find the command **mean(**, press `  and go to the **MATH** menu.)



* 1. By what number can you multiply each *PV* value and create a transformed power value data set (*TPV*) with a mean of 1?
	2. Enter the original *PV* data in a list (L3) and create another list (L4) for transformed data set *TPV*. Verify that the mean of *TPV* is 1.

For the 2006 season, the Chicago Bears won the NFC Championship and the Detroit Lions had the worst record for the season.

1. **a.** If the team rating *R* is given by *R* = *TSOS* + *TPV*, create a list L5 of the team ratings.
	1. Which team had the best (lowest) rating? Did this team win the NFC championship?
	2. Which team had the worst (highest) rating? Did this team have the worst record for the season?

Defining the team rating to be *R* = *TSOS* + *TPV* means that both variables have equal importance. If one variable is considered more important than the other, weights can be assigned to each variable. For example, if *SOS* is thought to be four times as important as PV, then one way to express this rating is *R* = 4 • *TSOS* + *TPV*.

1. **a.** Using this method, which team had the best rating? Did this team win the NFC championship?
	1. Which team had the worst rating? Did this team have the worst record for the season?

In general, if the weights used are *u* and *v*, then the rating is given by *R* = *u* • *TSOS* + *v* • *TPV*.

1. **a.** Find a set of weights (*u*, *v*) so that the rating for the Chicago Bears is the best (or explain why no such weights exist).
	1. Find a set of weights (*u*, *v*) so that the rating for the Detroit Lions is the worst (or explain why no such weights exist).

Student Page 3

Another way to transform sets of data with different scales is to measure how far the values are from their means in terms of their standard deviations. For example, if set A has a mean of 10 and a standard deviation of 2, and set B has a mean of 50 and a standard deviation of 10, a score of 7 in set A (1.5 standard deviations below the mean) would be relatively higher than a score of 40 in set B (1 standard deviation below the mean). Such transformed scores are called

*z*-scores. If *x* is a data value in a set of data *S*, then its *z*-score is *z* = *x*  mean(*S*)

standard deviation(*S*)

= *x*  *x* . The set of *z*-scores has a mean of 0 and a standard deviation of 1.

*S*

1. **a.** Using your calculator, create a list *ZSOS* for the *z*-score of the original set of data *SOS* as shown below. To name the list, insert **L** before *ZSOS* as follows: press ` , go to the **OPS** menu, and select **B:L** (this will indicate that the variable name is a list). Next, create a list *ZPV* for the *z*-score of the original set of data PV using the same process. (Remember, *SOS* is stored in L1 and *PV* is stored in L3.) Create a third list for the team ratings *R* = *ZSOS* + *ZPV*.



* 1. Using this method, which team had the best rating? Did this team win the NFC championship?
	2. Which team had the worst rating? Did this team have the worst record for the season?
1. **a.** Find a set of weights (*u*, *v*) so that the rating *R* = *u* • *ZSOS* + *v* • *ZPV* for the Chicago Bears is the best (or explain why no such weights exist).
	1. Find a set of weights (*u*, *v*) so that the rating *R* = *u* • *ZSOS* + *v* • *ZPV* for the Detroit Lions is the worst (or explain why no such weights exist)