
# PROJECTING KEY STATISTICS FOR FANTASY FOOTBALL

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By

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# ABSTRACT

The team, along with the help of Advanced Sports Logic (ASL), developed a method of creating projection systems to predict team performances in the National Football League. This projection method is intended to be used as a tool in online fantasy football. Additionally, we developed a system to rate a set of projections based on the accuracy and consistency of the projections.

# AUTHORSHIP

This report was developed through the collaborative efforts of Andrew Nersessian and Alex Presnal. All group members contributed equally to the completion of the project.

# EXECUTIVE SUMMARY

Advanced Sports Logic (ASL) provides software products for the fantasy football industry, using technology and mathematics to provide services for competitive players. Their primary product, "The Machine," is a comprehensive team management assistant, providing player selection help prior to and throughout the entire National Football League season. "The Machine's" success and effectiveness relies on the precision of the projected statistics that are being used.

The objective of this project was to lay the groundwork for the development of a projection method for football statistics to be used by "The Machine," as well as produce a rating system to score and compare the quality of various projections. Most existing football statistics projections are created through a player by player process, utilizing football knowledge and intuition. Our approach was to develop projections through a mathematical procedure via a top down approach, meaning statistics are projected at the team level and then allocated to each player. In order to rate a set of projections, two main factors must be examined, the accuracy and consistency. Accuracy is determined by calculating how close the projected value is to the actual value, while consistency is a measure of how much the projections for each statistic varies over time.

After projections were created for some team level statistics, it became clear that predictable trends within historical data were quite rare. This makes developing projections based solely on historical data nearly impossible. The most reliable projections will likely come through a combination of mathematics along with football knowledge and experience. In this regard, our top down projections will provide a baseline or starting point for projections, to be supplemented by expert knowledge and intuition – the effectiveness of the resulting combined

projections could then be measured by our rating system. The rating system that was produced is a simple and efficient way to grade and compare the overall value of projection sets, supplying a score between 0 and 100. It will be necessary to do further calibration of the rating system – right now, we don't know the ceiling for projection consistency and accuracy, so it's not clear what a "perfect score" of 100 will represent. We have developed a mechanism for calibration, which can be used to adjust the rating system as better projections become available.

# CONTENTS

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The team would like to thank Advanced Sports Logic for sponsoring this challenging project and providing all of the data that we needed in a timely and convenient manner. Specifically we would like to thank Leonard LaPadula, the President of Advanced Sports Logic for taking the time to sit down and discuss with us the specifics of the company along with the direction he saw this project going, along with Sridhar Seetharaman who was the programmer who worked in getting all of the data that we needed to us. Finally, we would like to thank Professor Jon Abraham for his guidance throughout the duration of this project.

# LIST OF FIGURES

# 1 INTRODUCTION

Since its creation over fifty years ago, fantasy football has deeply established itself into American culture and has become an obsession for numerous football fans. This unique form of entertainment and competition originally required checking Monday's newspapers for box scores and making several calculations manually throughout the National Football League's (NFL) season. This procedure has evolved and grown alongside technology, and is now a completely automated process through several online service providers. Approximately thirty-three million users participated in fantasy football leagues during the 2013 NFL season. With such a substantial customer base, fantasy football has developed into a multi-billion dollar industry through ad revenue and other services. Advanced Sports Logic (ASL) is an example of a company that provides services to fantasy football participants who wish to gain a competitive edge.

Advanced Sports Logic is a leader in fantasy football automation, providing customers with software, intellectual property and other services that make fantasy football simpler and less time consuming for hardcore users. Some of their products include Trade Judge and Projection Station, but their core product is simply known as The Machine. Throughout the duration of a season, The Machine works as the ultimate advice supplier for any fantasy football team owner. Before a fantasy league's draft even begins, The Machine has projections for each player in the NFL for each week of the season. In real time, The Machine recommends draft picks based on the user's previous selections as well as all of his or her opponents' choices. Prior to each week's games, The Machine provides the user with lineup, free agent claims and trade suggestions as well. The Machine's projections are continuously updated and improved throughout the season as it receives more information regarding player and team performances.

It is quite clear that the accuracy of The Machine's projections is the number one factor in determining its success as a system.

A main goal of this project is to begin developing a new projection system for The Machine through a top down process. This project team believes that football statistics cannot be predicted most accurately through a player by player basis. Instead, the best projections will come through calculating each NFL team's expected statistics for a given week, and expanding those projected statistics to the fantasy relevant players on each team. While modifying and improving upon some components of a previous MQP, a second objective of this project is to develop a projection rating system that will offer a numerical score to compare sets of projections.

# 2 BACKGROUND

## 2.1 FANTASY FOOTBALL BASICS

The structure and rules of fantasy football are quite simple, even for those inexperienced to the sport of football. A fantasy football league consists of multiple users who own and manage their own teams. Preceding the first week of the NFL's regular season, each league will hold a draft, in which the users take turns selecting players throughout the NFL to be on their fantasy team. Each week during the NFL regular season, users will face off against each other. The team that accumulates the most fantasy points during the week is declared the winner of the matchup. During the final few weeks of the regular season, a fantasy league will hold playoffs that eventually crown a league champion. Quite often, a fantasy league champion's only prize is bragging rights over friends for a year, but sometimes the winnings can include significant amounts of money.

## 2.2 TEAM ROSTERS

The roster requirements for a fantasy team can vary depending on the league. The possible positions allowed on a fantasy team include quarterbacks (QB), running backs (RB), wide receivers (WR), tight ends (TE), flex players, kickers (K) and defense/special teams (D/ST). Some leagues force users to select individual defensive players for their fantasy teams, but, more often than not, team owners only have to select NFL teams as a whole to acquire defensive and special teams fantasy points. An example of a roster format incudes one QB, two RBs, two WRs, one TE, one Flex (can be a RB, WR or TE), one K and one D/ST on the active roster, with six bench players as well. The bench players can be any combination of positions,

but their fantasy points for the week will not be included in the team's total. Throughout the season, team owners can adjust their lineups, trade players with other users and acquire free agents that do not belong to any fantasy team within the league. Once a player's actual NFL game begins each week, their position on the fantasy team is locked, and he cannot be added, dropped, traded, benched or placed on the active roster.

## 2.3 SCORING RULES

Players earn fantasy points through their performance during their NFL games. Fantasy points can be produced through five major categories, passing, receiving, rushing, kicking and defense/special teams. Although scoring rules can differ by league, an example of common scoring rules follows.

**Passing:**

- +1 point for every 25 passing yards
- +4 points for each TD pass
- +2 points for each two point conversion completion
- -2 points for each interception thrown
- -2 points for each fumble lost

**Receiving:**

- +1 point for every 10 receiving yards
- +6 points for each TD reception
- +2 points for each two point conversion reception
- -2 points for each fumble lost

**Rushing:**

- +1 point for every 10 rushing yards
- +6 points for each rushing TD
- +2 points for each successful two point conversion rush
- -2 points for each fumble lost

**Kicking:**

- +1 point for each extra point made
- +3 points for each field goal made between 0 and 39 yards
- +4 points for each field goal made between 40 and 49 yards
- +5 points for each field goal made greater than 49 yards

**Defense/Special Teams:**

- +2 points for each interception
- +2 points for each fumble recovery
- +2 points for each blocked punt or field goal
- +1 point for each sack
- +2 points for each safety
- +3 points for each defensive or special teams TD
- +10 points for 0 points allowed
- +7 points for 2-6 points allowed
- +4 points for 7-13 points allowed
- +1 point for 14-17 points allowed
- -1 points for 22-27 points allowed
- -4 points for 28-34 points allowed
- -7 points for 35-45 points allowed
- -10 points for 46 or more points allowed

## 2.4 PREVIOUS PROJECTION RATING SYSTEM

A previous MQP team that produced a projection rating system consisted of John Lucker, Patrick Maynard and Matthew Poppa. Their projection rating system is composed of finding the Pearson correlation between projections and actual data as well as finding the variance of each week's projections.

The Pearson correlation measures the linear association of two variables and is calculated by first determining the mean and standard variation of both variables. The mean can be found through the following equation, $\bar{X} = \frac{1}{n}\sum_{i=1}^{n} X_i$, while standard deviation can be found as follows, $S_X = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(X_i - \bar{X})^2}$, where $X_i$ represents the ith term in the data set and n represents the total

number of terms in the data set. Once the mean and standard deviation is calculated for both sets of data, the data sets must be standardized. This is done through the following equations, $X_i^1 = \frac{X_i - \bar{X}}{S_X}$ and $Y_i^1 = \frac{Y_i - \bar{Y}}{S_Y}$, where $X_i^1$ and $Y_i^1$ represent the ith standardized value in the projected and actual data sets respectively. Once the data is standardized, the Pearson correlation can be determined through one final step, $r = \frac{1}{n-1}\sum_{i=1}^{n} X_i^1 Y_i^1$. The resulting value will be between -1 and 1. A larger absolute value of r represents a stronger association between the two data sets. The sixteen correlations of the projections for each week are averaged to create a single score between -1 and 1, known as the final accuracy.

The variance of a data set is simply calculated by squaring its standard deviation. The projection system takes the variance of each week's projections and enters it into a function that outputs a score between 0 and 1. The sixteen converted variances are then averaged to establish a single variation score. The correlation and variation scores are then used to construct a final score, which is on a scale from 0 to 100, with a score of 100 representing perfect projections.

# 3 METHODOLOGY

## 3.1 PROJECTIONS

### 3.1.1 Projection Development Methods

When it comes to projecting the performance of NFL players, this team felt as though there are two different paths we could take to develop our final projections: a bottom-up approach a top-down approach. The bottom-up approach consists of focusing on projecting the statistics of an individual player. This could include looking at trends in their statistics in the recent past, their matchup against a player on the opposing team, and other individual characteristics. If desired, one could then combine these individual player projections to form a team-level projection. This method is actually the primary method used by professionals and experts in the field of fantasy football. This is due to the fact the most users of fantasy football usually only care about the individual players that they have drafted onto their team or the individuals that their opponents have for that week. The projections on a team level are not very relevant to one's fantasy matchup. However, we felt as though this method may lead to some inaccuracies. As an example, assume a team has four very talented wide receivers. Understandably, this does not usually happen in the NFL, but the exaggeration of the potential problem we see can be more easily seen with an extreme example. If we were to project how a receiver on this team might do based on individual ability, we might project that each of the receivers would have a very good game – around 100 yards receiving each. Combine these individual statistics with receiving yards and rushing yards from the running backs on this team and team level projections could be produced. However, combining all of these top tier performances by individual players may result in an unreasonable team level projection. The sum of individual projections could lead to a team projection of 500 receiving yards, but the

quarterback could originally only be projected to pass for 400 yards (i.e. our projections would not lineup). It is for this reason that we chose to use a top-down method for our projections.

The top-down method is essentially the reversed process of the bottom-up method. Rather than combining individual player projections into a team-level projection (if desired), projections are initially formed at the team-level. Once these statistics are projected, individual players can be allocated points from the team-level. This top-down approach ensures that the sum of the parts (players) equals the whole (team) – an error that could occur with the bottom-up approach. Once we decided to use this top-down approach, we then had to ask ourselves how we were going to develop these team-level projections.

### 3.1.2 Our Projection Process

Before developing a method for calculating projections, we strategized over what process to take to reach projections for total passing yards and total rushing yards in a game for any team's offense during any given week. Total passing and rushing yards for a team is a very important and fundamental statistic because quarterbacks, running backs, wide receivers and tight ends' majority of fantasy points are directly related to at least one of the two.

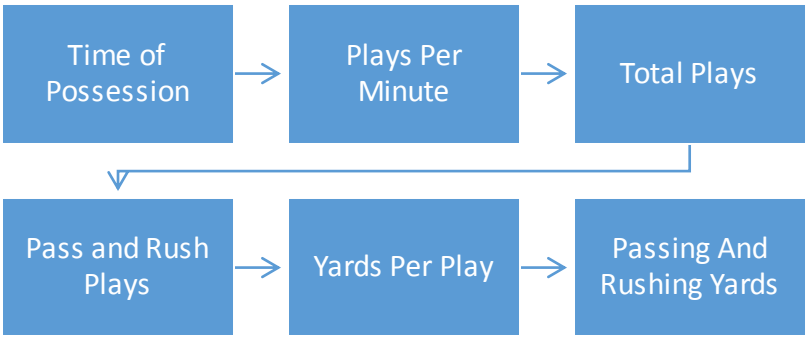


*Figure 1: Summary of Passing and Rushing Yard Projection Process*

The first step of the process that we constructed is projecting time of possession. Time of possession is the total sum of time a team is on offense during a sixty minute game. Simply, time of possession indicates the portion of time a team will be able to accumulate offensive statistics. Next, an average plays run per minute for a team's offense is projected. Plays per minute measures the pace at which an offense functions. Multiplying the projections for time of possession and plays run per minute for a team allows a prediction for total number of plays run by an offense during a game to be produced. Once a value for total plays is projected, the number of rushing and passing plays out of the total plays can be projected. Next, the average number of yards per play for both passing and rushing plays must be estimated. Finally, the projections for yards per play and number of plays are combined to create predictions for total passing yards and total rushing yards in a game by a team's offense.

### 3.1.3 Calculating Projections

After some consideration, we developed a method for calculating any of the above statistics for all NFL teams for the 2013 season, excluding statistics that are simply a combination of two other statistics. First, the average of the given statistic must be taken from the previous three weeks for each team's offense, starting with week one and continuing the process through week seventeen. Calculating these averages for the first three weeks will require looking at 2012 data. At this starting point, we are assuming no prior knowledge of any 2013 season results, thus using the recently calculated averages as actual results as the averaging continues past the starting week. A small problem occurs when the process reaches the three weeks after a team's bye week. In this case, the bye week must be ignored and the fourth previous week must be included in the average in order to take into account the three most recent games.

Next, the same process is repeated, except this time for the statistical value allowed by each team's defense in each week. Once the three week averages are calculated for each team's offense and defense, a given team's offensive three week average is averaged with their opponent's defensive three week average for every week of the season, resulting in what can be considered the "three week projection." This process is repeated twice more, once with six weeks and another using nine weeks. Naturally, these can be called the "six week projections" and "nine week projections." After the end of each week of the season, another week of statistics is added to the pool of available data and the entire projection procedure must be duplicated for the remaining weeks of the season. These 3, 6, and 9 week projection matrices can be found in the green tabs of the 2013MQPData Excel file under the tabs labelled in the following chart:

| Statistic | Tab Label |
|---|---|
| Time of Possession | TOP |
| Plays Per Minute | PPM |
| Percentage of Pass Plays | Pass Play % |
| Percentage of Rush Plays | Rush Play % |
| Pass Yards Per Play | Pass YPP |
| Rush Yards Per Play | Rush YPP |

*Figure 2: Tab Labels for 2013MQPData File*

Once the three, six and nine week projections are calculated for each point in time of the season, a weighted combination of three are utilized to create a set of final projections. These final projections are developed into an upper triangular matrix for each team, which will be explained in detail in the next section. Using the 32 matrices, the projections can be compared to

the actual data for a given statistic. The weights for the three original projections can be optimized to minimize the total error of the system, which is the total sum of the absolute values of the difference between each projection and its corresponding actual.

### 3.1.4 Upper Triangular Matrix

Once we established a method for developing projections, a technique for organizing the weekly projections was required. For a given statistic, we want to project it for the upcoming NFL week, along with all of the weeks remaining in the NFL season. These week by week projections could then be plugged into The Machine to help aid in player trading decisions, free agent add/drops, etc. To create these weekly projection charts, we created upper-triangular matrices to reflect the projections made and at whatever point in the season they were made. We began with our preseason projections. Just prior to week one, we wish to project what we thought would happen not only in week 1, but each week of the seventeen week season. These preseason projections would fill in the first row of our matrix. The first cell of this row would be what we projected to occur in week one, the second cell would be our week 2 projection, and so on until the seventeenth cell, which would hold our week seventeen projection. Assuming only an eight week season for simplicity purposes, the following is an example of preseason projections for team rushing yards and the first entry in an upper-triangular matrix:

| WEEK | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| 1 | ***80*** | 68 | 168 | 85 | 104 | 86 | 81 | 85 |

*Figure 3: Example of Projections Prior to Week 1*

The bolded 80 value in week one, column one represents our projection for what would happen in this team's week one game just prior to week one occurring. The remainder of the columns are filled in with projections on a weekly basis for the remainder of the season. At the completion of

week one, we would want to again project what would happen in the upcoming week, while incorporating what happened in the previous week. Therefore, we would project statistics for the week two NFL matchups along with completing our weekly projections for the remainder of the NFL season (weeks three through seventeen). These projections would fill out the second row of our matrix. However, instead of starting in the first column, our projections would fill row two for columns two through seventeen. By formatting it this way, all of our week two projections will be in the same column. The same goes for our week three projections and so on. Updating our example, the new matrix would look as follows:

| WEEK | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| 1 | ***80*** | 68 | 168 | 85 | 104 | 86 | 81 | 85 |
| 2 | | ***75*** | 84 | 83 | 92 | 92 | 85 | 114 |

*Figure 4: Projections Prior to Week 2*

It is clear to see the offset data that reflects the week for which each projection is being made. At the completion of week two, we repeat the process for week three and continue this method after every week until the completion of the NFL season. The following is an example of a completed upper-triangular matrix:

| WEEK | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| 1 | ***80*** | 68 | 168 | 85 | 104 | 86 | 81 | 85 |
| 2 | | ***75*** | 84 | 83 | 92 | 92 | 85 | 114 |
| 3 | | | ***118*** | 94 | 110 | 71 | 82 | 92 |
| 4 | | | | ***96*** | 135 | 62 | 83 | 104 |
| 5 | | | | | ***122*** | 70 | 84 | 101 |
| 6 | | | | | | ***68*** | 84 | 91 |
| 7 | | | | | | | ***83*** | 96 |
| 8 | | | | | | | | ***94*** |

*Figure 5: Entire Season of Weekly Projections*

For a given week *i*, the weekly projections would fill in row *i* for columns *i* through 17 – or *i* through 8 for our simplified example (leaving columns 1 through *i* empty). This process generates an upper-triangular matrix with the diagonal representing all of our projections for a given week just prior to that week occurring. Any cell beneath this diagonal would be left blank. For the cells above this diagonal, the row value of the cell represents the week at which the projection was made and the column represents the week that we are trying to project for. We developed these upper triangular matrices for every team and each statistic in our projection process. These matrices can be found in the red tabs of the 2013MQPData Excel file with the following tab labels:

| Statistic | Tab |
|---|---|
| Time of Possession | TOP Projection |
| Plays Per Minute | PPM Projection |
| Total Passing Play Counts | Plays Projection |
| Total Rushing Play Counts | Plays Projection |

| | |
|---|---|
| Passing Yards Per Play | YPP Projection |
| Rushing Yards Per Play | YPP Projection |
| Total Passing Yards | Yards Projection |
| Total Rushing Yards | Yards Projection |

*Figure 6: Tab Labels for Projection Matrices*

## 3.2 PROJECTION RATING SYSTEM

Once a projection development procedure was created, we began constructing a projection rating system in order to discover the quality of our projections and compare them against other sets of projections. While receiving some influence from a past MQP, we desired to develop a rating system that effectively produced a single numerical value as a score. There are two main measurements for determining the quality of a set of projections, accuracy and consistency.

### 3.2.1 Accuracy

Arguably the most important measurement regarding projections, accuracy determines how close a set of predicted values is to the actual values. The previous MQP team utilized the Pearson Correlation in order to calculate the accuracy of projections compared to actual data. After experimenting with the Pearson Correlation, we uncovered an unfortunate flaw with this system. For example, let a set of actual values be 105, 99, 111 and 113 and let a set of projected values simply be 100 more than the actual, or 205, 199, 211 and 213. This will result in a Pearson Correlation value of 1, which is supposed to represent the highest possible accuracy. It is quite clear that these projections are significantly inaccurate and do not deserve a perfect score. After this discovery, we felt our projection rating system required an alternative form for measuring accuracy.

To calculate accuracy, we wanted to develop a way to measure the average percent of error for each projection for a given statistic and scale that value into a score between zero and one. For one of the seventeen weeks in the season, we measure total error by summing the squared differences of the projected values and actual values, divided by the actual values for all 32 teams. The average of all seventeen of these calculations is then taken. The formula for this process is as follows: $\frac{\sum_{i=1}^{17}\sum_{j=1}^{32}\frac{(P_{ij}-A_{ij})^2}{A_{ij}}}{17}$, where $P_{ij}$ is the projected value in week i for team j and $A_{ij}$ is the actual value in week i for team j. These error calculations can be found in the blue tabs of the 2013MQPData Excel file, with each tab being labeled by the individual statistic it contains (i.e. "TOP Accuracy" contains our accuracy calculation for our time of possession projections).

Once the value for the average total error is calculated, an inverse exponential scaling function is utilized, $f(average\ total\ error) = K^{avg.\ total\ error}$. K is a constant that is solved by letting a score of 0.5 represent an average total error equivalent to the league average for the statistic in which projections are being tested. This step is somewhat arbitrary, but we believe that it produces results that best fit the rating system. It allows a score of 1 to represent zero percent error, a score of 0.9 to represent an average error of roughly seven percent, a score of 0.8 to represent an average error of approximately ten percent and a score of 0.7 to represent an average error of about thirteen percent, while a score of zero indicates an infinitely inaccurate set of projections. The chart of our scores vs. average percent error can be seen below:

| % Error | Score |
|---|---|
| 0 | 1 |
| 1 | 0.997914 |
| 2 | 0.991683 |

| | |
|---|---|
| 3 | 0.981384 |
| 4 | 0.967144 |
| 5 | 0.949139 |
| 6 | 0.927588 |
| 7 | 0.902748 |
| 8 | 0.874912 |
| 9 | 0.844401 |
| 10 | 0.811558 |
| 11 | 0.776742 |
| 12 | 0.740321 |
| 13 | 0.702668 |
| 14 | 0.664151 |
| 15 | 0.625128 |
| 16 | 0.585947 |
| 17 | 0.546933 |
| 18 | 0.508389 |
| 18.22 | 0.5 |
| 19 | 0.470591 |
| 20 | 0.433789 |

*Figure 7: Scoring System Based on Average Total Error*

### 3.2.2 Consistency

In addition to accuracy, there is another metric with which we wanted to analyze our data: consistency. While it may not be as important of a measure for a projection system, it is definitely something to consider. For fantasy football team owners, player moves do not end at the initial preseason draft. Trades and Add/Drop acquisitions can be made throughout the year to change your team roster and hopefully boost your chances of winning. As a result, the consistency of our projections for weeks in the far future can be relevant for trading players or adjusting your lineup. If we only focused on pre-week projections, we would not be able to offer fantasy users long term trade suggestions.

In order to measure our consistency (or inconsistency), we decided to use variances of our week-to-week projections. Using our upper-triangular matrices, we took the variances of each column of the matrix – 16 variances in all if you exclude the team's bye week. We then

averaged these 16 variances for each team and averaged the 32 team values to come up with a final average variance for the totality of each projection. These variance totals will measure any volatility in our projections from week-to-week. Using a similar process to the one explain in the previous section for accuracy, we developed an inverse exponential scale from 0 to 1 using the league average to represent a score of 0.5. We then took our variances and input them into our scoring system to come up with a final variance score on a scale of 0 to 1.

### 3.2.3 Final Score

Once scores are calculated for both accuracy and consistency, the rating system must provide a final score. By multiplying the accuracy score by 75 and the consistency score by 25, a final score between 0 and 100 is provided. Again, a score of 100 represents a set of perfect projections, while a score of 0 can be interpreted as an infinitely poor set of projections. The weights corresponding to accuracy and consistency can be modified to match the preferences of any user, as long as they sum to 100. We chose the weights of 75 and 25 for accuracy and consistency respectively because we believe that although consistency is important, accuracy plays a larger role in indicating the quality of a set of projections

# 4 RESULTS AND CONCLUSIONS

## 4.1 OUR PROJECTIONS

All of the projections that were produced through our system appeared to be realistic and plausible outcomes. The system utilizes past performances along with the strength of a team's opponent to generate predictions, which seems to be a quite reasonable approach. Unfortunately, when these projections were tested for accuracy and consistency using the rating system we developed, they were proven to be rather poor. Our set of projections for total passing yards and total rushing yards, which are two of the most key statistics for fantasy football, both received a score of less than 10 out of the possible 100. This represents a significantly large average percent of error for each predicted value.

Although these results are disappointing, they are not surprising. Projecting football statistics through a strictly mathematical approach, looking only at historical data, is a very difficult task. The number of factors that can potentially affect a game of football is overwhelming and creating a mathematical system that takes into account all of them is inconceivable. For example, our top-down approach did not take into account player injuries because the system's beginning stages only worries about team level statistics. There are certain players that have such a significant impact on their team that their absence in a game would result in a drastically worse team performance than what would be originally expected.

Although these projections are not recommended to be used in a standalone manner, the effort that was used to develop them is not wasted. The projection system is unable to match the volatility that naturally accompanies weekly football statistics, but over the length of an NFL season, the sums of teams' projections possess relatively improved accuracy. This means that

our projection system can be used to predict season totals for key statistics. The weekly projections can also be used as baseline projections and modified or altered in multiple ways. Our projections can be combined with one or more other methods of projecting to form a blended prediction. The projections we developed can also be tweaked by a fantasy football expert on a weekly basis. It is clear that mathematics alone will not produce a superior set of projections. Predicting football statistics is not a science, otherwise there would exist a single best form of projecting. Instead, it is a combination of being a science and an art. Mathematics joined with extensive football knowledge and projecting experience will produce the greatest results.

## 4.2 Our Rating System

As a whole, we feel as though we helped to create a new and improved version of a rating system that is an effective way of determining the accuracy and consistency of a given set of projections. While last year's project laid a great groundwork for rating a projection system, applying variances to measure volatility/consistency in projections while using the sum of squared differences of the projections versus the actual divided by the actual to measure overall accuracy led to a system that provided a proper scale with which to measure projections. Based on the typical level of accuracy in projections seen today, our system scores a set of projections' accuracy with a score of 0.9 if it has around 7% average error, a 0.8 for roughly 10% average error, 0.7 for 13% error, and so on down an inverse exponential scale. We think that this is a reasonable expectation to set, again, based on today's typical level of accuracy. Moving forward, technology is going to improve in the future. We can only assume that projection systems for fantasy football will also improve along with technology. As a result, our projection system will need to be recalibrated to reflect industry standards. As an example, perhaps in five years,

projection systems will easily project within 5% total error and a set of projections within 2 to 3% error would be considered good projections. Our scale would need to be recalibrated so that the 5% total error would not reflect the score of approximately 92 that it currently gives.

# APPENDIX A

The following is intended to provide clarification and work as a guide when examining the 2013MQPData excel file. The first tab of interest is labeled as Player Stats. This tab contains all of the actual data from the 2012 and 2013 seasons for all 32 teams and players for every fantasy relevant statistic.

The green tabs contain the first steps in calculating the projections. They are labeled by the abbreviations of the statistics they represent and Figure 2 above can work as a key. The furthest left groups of cells are both offensive and defensive actual data for the given statistic for the entirety of the 2012 and 2013 seasons for every team. To the right, a table can be found containing each team's opponent for every week of the 2013 season. Finally, for the given statistic, the tabs contain the offensive and defensive three, six and nine weeks calculated averages for every team at every point in time during the season as well as the three, six and nine week projections.

Next, the red tabs possess the upper-triangular matrices for projected and actual data and error for every team for a given statistic. They are labeled as the "given statistic" Projection. From left to right, the matrices for each team are constructed in alphabetical order. In these tabs, the weights for the three, six and nine week projections can be modified in the yellow cells. Consistency is also measured in these tabs. Below every week of each team's projection matrix, the variances are calculated and used to generate a consistency score, based on the K value in the far left side of the tab.

The blue tabs are filled with the calculations for measuring accuracy. They are labeled in a similar fashion as before. To the left, the projected values are above the actual values for every

team and week for a given statistic. The calculations for total error and average total error are found to the right of that.

Finally, the orange tabs possess calculations that were used to test the accuracy scoring of a given statistic. In these tabs, by adding a certain percentage to the actual values, new projections were formed in order to experiment with different errors being represented by different accuracy scores. The K values for accuracy and the accuracy scores from the original projections can also be found here.