Homework 1

Group 1

Contents

1 Data Exploration

The following table provides the descriptive statistics regarding our data set. You will find that

Describe the size and the variables in the moneyball training data set. Consider that too much detail will cause a manager to lose interest while too little detail will make the manager consider that you aren't doing your job. Some suggestions are given below. Please do NOT treat this as a check list of things to do to complete the assignment. You should have your own thoughts on what to tell the boss. These are just ideas.

Descriptive Statistics
16 Variables 2276 Observations

TARGET_WINS

```
     n  missing  unique  Info   Mean   .05   .10   .25   .50   .75   .90    .95
  2276        0     108     1  80.79  54.0  61.0  71.0  82.0  92.0  99.5  104.0

lowest :   0  12  14  17  21, highest: 128 129 134 135 146
```

TEAM_BATTING_H

```
     n  missing  unique  Info   Mean   .05   .10   .25   .50   .75   .90   .95
  2276        0     569     1   1469  1282  1315  1383  1454  1537  1636  1695

lowest :  891  992 1009 1116 1122, highest: 2333 2343 2372 2496 2554
```

TEAM_BATTING_2B

```
     n  missing  unique  Info   Mean  .05  .10  .25  .50  .75  .90  .95
  2276        0     240     1  241.2  167  182  208  238  273  303  320

lowest :  69 112 113 118 123, highest: 382 392 393 403 458
```

TEAM_BATTING_3B

```
     n  missing  unique  Info   Mean  .05  .10  .25  .50  .75  .90  .95
  2276        0     144     1  55.25   23   27   34   47   72   96  108

lowest :   0   8   9  11  12, highest: 166 190 197 200 223
```

TEAM_BATTING_HR

```
     n  missing  unique  Info   Mean   .05   .10   .25    .50    .75    .90    .95
  2276        0     243     1  99.61  14.0  20.0  42.0  102.0  147.0  179.5  199.0

lowest :   0   3   4   5   6, highest: 247 249 257 260 264
```

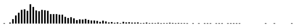
TEAM_BATTING_BB

```
   n  missing  unique  Info   Mean    .05    .10    .25    .50    .75    .90    .95
2276        0     533     1  501.6  248.2  363.5  451.0  512.0  580.0  635.0  670.2

lowest :   0  12  29  34  45, highest: 815 819 824 860 878
```

TEAM_BATTING_SO

```
   n  missing  unique  Info   Mean   .05   .10   .25   .50   .75   .90   .95
2174      102     822     1  735.6   359   421   548   750   930  1049  1103

lowest :    0   66   67   72   74, highest: 1303 1320 1326 1335 1399
```

TEAM_BASERUN_SB



```
   n  missing  unique  Info   Mean    .05    .10    .25    .50    .75    .90    .95
2145      131     348     1  124.8   35.0   44.0   66.0  101.0  156.0  231.0  301.8

lowest :   0  14  18  19  20, highest: 562 567 632 654 697
```

TEAM_BASERUN_CS

```
   n  missing  unique  Info   Mean  .05  .10  .25  .50  .75  .90  .95
1504      772     128     1   52.8   24   30   38   49   62   77   91

lowest :   0   7  11  12  14, highest: 171 186 193 200 201
```

TEAM_BATTING_HBP

```
  n  missing  unique  Info   Mean   .05   .10   .25   .50   .75   .90   .95
191     2085      55     1  59.36  40.0  44.0  50.5  58.0  67.0  76.0  82.5

lowest : 29 30 35 38 39, highest: 87 88 89 90 95
```

TEAM_PITCHING_H

```
   n  missing  unique  Info   Mean   .05   .10   .25   .50   .75   .90   .95
2276        0     843     1   1779  1316  1356  1419  1518  1682  2058  2563

lowest :  1137  1168  1184  1187  1202
highest: 16038 16871 20088 24057 30132
```

TEAM_PITCHING_HR

```
   n  missing  unique  Info   Mean   .05   .10   .25    .50    .75    .90    .95
2276        0     256     1  105.7  18.0  25.0  50.0  107.0  150.0  187.0  209.2

lowest :   0   3   4   5   6, highest: 291 297 301 320 343
```

TEAM_PITCHING_BB

```
   n  missing  unique  Info   Mean    .05    .10    .25    .50    .75    .90    .95
2276        0     535     1    553  377.0  417.5  476.0  536.5  611.0  693.5  757.0

lowest :    0  119  124  131  140, highest: 2169 2396 2840 2876 3645
```

TEAM_PITCHING_SO

```
   n  missing  unique  Info   Mean    .05    .10    .25    .50    .75     .90     .95
2174      102     823     1  817.7  421.3  490.0  615.0  813.5  968.0  1095.0  1173.0

lowest :     0   181   205   208   252
highest:  3450  4224  5456 12758 19278
```

TEAM_FIELDING_E

```
   n  missing  unique  Info   Mean    .05    .10    .25    .50    .75    .90    .95
2276        0     549     1  246.5  100.0  109.0  127.0  159.0  249.2  542.0  716.0

lowest :   65   66   68   72   74, highest: 1567 1728 1740 1890 1898
```

TEAM_FIELDING_DP

```
   n  missing  unique  Info   Mean  .05  .10  .25  .50  .75  .90  .95
1990      286     144     1  146.4   98  109  131  149  164  178  186

lowest :  52  64  68  71  72, highest: 215 218 219 225 228
```

a. Mean / Standard Deviation / Median
b. Bar Chart or Box Plot of the data
c. Is the data correlated to the target variable (or to other variables?)
d. Are any of the variables missing and need to be imputed “fixed”?

2 Data Preparation

Describe how you have transformed the data by changing the original variables or creating new variables. If you did transform the data or create new variables, discuss why you did this. Here are some possible transformations. a. Fix missing values (maybe with a Mean or Median value) b. Create flags to suggest if a variable was missing c. Transform data by putting it into buckets d. Mathematical transforms such as log or square root (or use Box-Cox) e. Combine variables (such as ratios or adding or multiplying) to create new variables

3 Build Models

Using the training data set, build at least three different multiple linear regression models, using different variables (or the same variables with different transformations). Since we have not yet covered automated variable selection methods, you should select the variables manually (unless you previously learned Forward or Stepwise selection, etc.). Since you manually selected a variable for inclusion into the model or exclusion into the model, indicate why this was done. Discuss the coefficients in the models, do they make sense? For example, if a team hits a lot of Home Runs, it would be reasonably expected that such a team would win more games. However, if the coefficient is negative (suggesting that the team would lose more games), then that needs to be discussed. Are you keeping the model even though it is counter intuitive? Why? The boss needs to know.

4 Select Models

Decide on the criteria for selecting the best multiple linear regression model. Will you select a model with slightly worse performance if it makes more sense or is more parsimonious? Discuss why you selected your model. For the multiple linear regression model, will you use a metric such as Adjusted R2 , RMSE, etc.? Be sure to explain how you can make inferences from the model, discuss multi-collinearity issues (if any), and discuss other relevant model output. Using the training data set, evaluate the multiple linear regression model based on (a) mean squared error, (b) R2 , (c) F-statistic, and (d) residual plots. Make predictions using the evaluation data set.

5 Appendix A

5.1 Data Dictionary

VARIABLE.NAME..	DEFINITION	THEORETICAL.EFFECT
INDEX	Identification Variable (do not use)	None
TARGET_WINS	Number of wins	NA
TEAM_BATTING_H	Base Hits by batters (1B,2B,3B,HR)	Positive Impact on Wins
TEAM_BATTING_2B	Doubles by batters (2B)	Positive Impact on Wins
TEAM_BATTING_3B	Triples by batters (3B)	Positive Impact on Wins
TEAM_BATTING_HR	Homeruns by batters (4B)	Positive Impact on Wins
TEAM_BATTING_BB	Walks by batters	Positive Impact on Wins
TEAM_BATTING_HBP	Batters hit by pitch (get a free base)	Positive Impact on Wins
TEAM_BATTING_SO	Strikeouts by batters	Negative Impact on Wins
TEAM_BASERUN_SB	Stolen bases	Positive Impact on Wins
TEAM_BASERUN_CS	Caught stealing	Negative Impact on Wins
TEAM_FIELDING_E	Errors	Negative Impact on Wins
TEAM_FIELDING_DP	Double Plays	Positive Impact on Wins
TEAM_PITCHING_BB	Walks allowed	Negative Impact on Wins
TEAM_PITCHING_H	Hits allowed	Negative Impact on Wins
TEAM_PITCHING_HR	Homeruns allowed	Negative Impact on Wins
TEAM_PITCHING_SO	Strikeouts by pitchers	Positive Impact on Wins

5.2 R code used in document