DATA 607 Project 1: Chess Tournament Results

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1. Project Description

In this project, you're given a text file with chess tournament results where the information has some structure. Your job is to create an R Markdown file that generates a .CSV file (that could for example be imported into a SQL database) with the following information for all of the players:

Player's Name, Player's State, Total Number of Points, Player's Pre-Rating, and Average Pre Chess Rating of Opponents For the first player, the information would be:

Gary Hua, ON, 6.0, 1794, 1605

1605 was calculated by using the pre-tournament opponents' ratings of 1436, 1563, 1600, 1610, 1649, 1663, 1716, and dividing by the total number of games played.

If you have questions about the meaning of the data or the results, please post them on the discussion forum. Data science, like chess, is a game of back and forth…

The chess rating system (invented by a Minnesota statistician named Arpad Elo) has been used in many other contexts, including assessing relative strength of employment candidates by human resource departments.

You may substitute another text file (or set of text files, or data scraped from web pages) of similar or greater complexity, and create your own assignment and solution. You may work in a small team. All of your code should be in an R markdown file (and published to rpubs.com); with your data accessible for the person running the script.

2. Project Raw Data

The raw data is a text file with unstructured data strings.

```
raw_data <- readLines('https://raw.githubusercontent.com/oggyluky11/DATA607-Project-1/master/tournament
```

```
## Warning in readLines("https://raw.githubusercontent.com/oggyluky11/DATA607-
## Project-1/master/tournamentinfo.txt"): incomplete final line found on
## 'https://raw.githubusercontent.com/oggyluky11/DATA607-Project-1/master/
## tournamentinfo.txt'
```

```
head(raw_data)
```

```
## [1] "-----------------------------------------------------------------------------------------"
## [2] " Pair | Player Name                     |Total|Round|Round|Round|Round|Round|Round|Round| "
## [3] " Num  | USCF ID / Rtg (Pre->Post)       | Pts |  1  |  2  |  3  |  4  |  5  |  6  |  7  | "
## [4] "-----------------------------------------------------------------------------------------"
## [5] "    1 | GARY HUA                        |6.0  |W  39|W  21|W  18|W  14|W   7|D  12|D   4|"
## [6] "   ON | 15445895 / R: 1794   ->1817     |N:2  |W    |B    |W    |B    |W    |B    |W    |"
```

3. Raw Data Manipulation

a. Restructure raw data into dataframe

In raw data, double lines of strings are used to store one 'row' of data. Data columns are seperated by "|". Let's see what this raw data should look like in a real data frame. This step is not requested in this project but it is good to represent the raw data into the way it should look like as data preparation.

```
library(dplyr)
```

```
##
## Attaching package: 'dplyr'

## The following objects are masked from 'package:stats':
##
##     filter, lag

## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
library(tidyr)
library(stringr)
#remove the last character "|"
raw_data <- str_trim(raw_data[str_detect(raw_data,'------')==FALSE],'right')
raw_data <- substr(raw_data, 1 ,nchar(raw_data)-1)

#Combine two lines of data into one row
raw_data2 <- character()
for (i in (1:length(raw_data))) {
  if(i%%2==0) {
    line_odd <- str_trim(unlist(str_split(raw_data[i-1], '\\|')))
    line_even <- str_trim(unlist(str_split(raw_data[i], '\\|')))
    line_cat <- str_c(line_odd,line_even,sep = ' ', collapse = ',')
    raw_data2 <- append(raw_data2,line_cat)
  }
}
raw_data2 <-data.frame(raw_data2)
raw_data_frame <- raw_data2 %>% separate(raw_data2, as.character(c(1:10)), sep = ',', extra = 'drop')

#Set first row as header and rename columns
names(raw_data_frame)<- unlist(raw_data_frame[1,])
raw_data_frame <- raw_data_frame[-1,]
raw_data_frame
```

```
##    Pair Num                   Player Name USCF ID / Rtg (Pre->Post)
## 2      1 ON                   GARY HUA 15445895 / R: 1794   ->1817
## 3      2 MI            DAKSHESH DARURI 14598900 / R: 1553   ->1663
## 4      3 MI               ADITYA BAJAJ 14959604 / R: 1384   ->1640
## 5      4 MI        PATRICK H SCHILLING 12616049 / R: 1716   ->1744
## 6      5 MI                 HANSHI ZUO 14601533 / R: 1655   ->1690
## 7      6 OH                HANSEN SONG 15055204 / R: 1686   ->1687
## 8      7 MI           GARY DEE SWATHELL 11146376 / R: 1649   ->1673
## 9      8 MI         EZEKIEL HOUGHTON 15142253 / R: 1641P17->1657P24
## 10     9 ON                 STEFANO LEE 14954524 / R: 1411   ->1564
## 11    10 MI                   ANVIT RAO 14150362 / R: 1365   ->1544
## 12    11 MI    CAMERON WILLIAM MC LEMAN 12581589 / R: 1712   ->1696
## 13    12 MI              KENNETH J TACK 12681257 / R: 1663   ->1670
## 14    13 MI           TORRANCE HENRY JR 15082995 / R: 1666   ->1662
## 15    14 MI                BRADLEY SHAW 10131499 / R: 1610   ->1618
## 16    15 MI   ZACHARY JAMES HOUGHTON 15619130 / R: 1220P13->1416P20
## 17    16 MI                MIKE NIKITIN 10295068 / R: 1604   ->1613
## 18    17 MI          RONALD GRZEGORCZYK 10297702 / R: 1629   ->1610
## 19    18 MI               DAVID SUNDEEN 11342094 / R: 1600   ->1600
## 20    19 MI                DIPANKAR ROY 14862333 / R: 1564   ->1570
## 21    20 MI                 JASON ZHENG 14529060 / R: 1595   ->1569
## 22    21 ON               DINH DANG BUI 15495066 / R: 1563P22->1562
## 23    22 MI            EUGENE L MCCLURE 12405534 / R: 1555   ->1529
## 24    23 ON                    ALAN BUI 15030142 / R: 1363   ->1371
## 25    24 MI           MICHAEL R ALDRICH 13469010 / R: 1229   ->1300
## 26    25 MI            LOREN SCHWIEBERT 12486656 / R: 1745   ->1681
## 27    26 ON                     MAX ZHU 15131520 / R: 1579   ->1564
## 28    27 MI              GAURAV GIDWANI 14476567 / R: 1552   ->1539
## 29    28 MI  SOFIA ADINA STANESCU-BELLU 14882954 / R: 1507   ->1513
## 30    29 MI         CHIEDOZIE OKORIE 15323285 / R: 1602P6 ->1508P12
## 31    30 ON          GEORGE AVERY JONES 12577178 / R: 1522   ->1444
## 32    31 MI                RISHI SHETTY 15131618 / R: 1494   ->1444
## 33    32 ON       JOSHUA PHILIP MATHEWS 14073750 / R: 1441   ->1433
## 34    33 MI                     JADE GE 14691842 / R: 1449   ->1421
## 35    34 MI      MICHAEL JEFFERY THOMAS 15051807 / R: 1399   ->1400
## 36    35 MI            JOSHUA DAVID LEE 14601397 / R: 1438   ->1392
## 37    36 MI               SIDDHARTH JHA 14773163 / R: 1355   ->1367
## 38    37 MI     AMIYATOSH PWNANANDAM 15489571 / R:  980P12->1077P17
## 39    38 MI                   BRIAN LIU 15108523 / R: 1423   ->1439
## 40    39 MI               JOEL R HENDON 12923035 / R: 1436P23->1413
## 41    40 MI                FOREST ZHANG 14892710 / R: 1348   ->1346
## 42    41 MI       KYLE WILLIAM MURPHY 15761443 / R: 1403P5 ->1341P9
## 43    42 MI                    JARED GE 14462326 / R: 1332   ->1256
## 44    43 MI           ROBERT GLEN VASEY 14101068 / R: 1283   ->1244
## 45    44 MI          JUSTIN D SCHILLING 15323504 / R: 1199   ->1199
## 46    45 MI                   DEREK YAN 15372807 / R: 1242   ->1191
## 47    46 MI JACOB ALEXANDER LAVALLEY 15490981 / R:  377P3 ->1076P10
## 48    47 MI                 ERIC WRIGHT 12533115 / R: 1362   ->1341
## 49    48 MI                DANIEL KHAIN 14369165 / R: 1382   ->1335
## 50    49 MI         MICHAEL J MARTIN 12531685 / R: 1291P12->1259P17
## 51    50 MI                  SHIVAM JHA 14773178 / R: 1056   ->1111
## 52    51 MI              TEJAS AYYAGARI 15205474 / R: 1011   ->1097
## 53    52 MI                   ETHAN GUO 14918803 / R:  935   ->1092
## 54    53 MI               JOSE C YBARRA 12578849 / R: 1393   ->1359
## 55    54 MI                 LARRY HODGE 12836773 / R: 1270   ->1200
## 56    55 MI                   ALEX KONG 15412571 / R: 1186   ->1163
## 57    56 MI                MARISA RICCI 14679887 / R: 1153   ->1140
## 58    57 MI                  MICHAEL LU 15113330 / R: 1092   ->1079
## 59    58 MI                VIRAJ MOHILE 14700365 / R:  917   -> 941
## 60    59 MI           SEAN M MC CORMICK 12841036 / R:  853   -> 878
## 61    60 MI                  JULIA SHEN 14579262 / R:  967   -> 984
## 62    61 ON            JEZZEL FARKAS 15771592 / R:  955P11-> 979P18
## 63    62 MI               ASHWIN BALAJI 15219542 / R: 1530   ->1535
## 64    63 MI        THOMAS JOSEPH HOSMER 15057092 / R: 1175   ->1125
## 65    64 MI                      BEN LI 15006561 / R: 1163   ->1112
##    Total Pts Round 1 Round 2 Round 3 Round 4 Round 5 Round 6 Round 7
## 2    6.0 N:2 W  39 W W  21 B W  18 W W  14 B W   7 W D  12 B D   4 W
## 3    6.0 N:2 W  63 B W  58 W L   4 B W  17 W W  16 B W  20 W W   7 B
## 4    6.0 N:2 L   8 W W  61 B W  25 W W  21 B W  11 W W  13 B W  12 W
## 5    5.5 N:2 W  23 W D  28 B W   2 W W  26 B D   5 W W  19 B D   1 B
## 6    5.5 N:2 W  45 B W  37 W D  12 B D  13 W D   4 B W  14 W W  17 B
## 7    5.0 N:3 W  34 W D  29 B L  11 W W  35 B D  10 B W  27 W W  21 B
## 8    5.0 N:3 W  57 W W  46 B W  13 W W  11 B L   1 B W   9 W L   2 W
## 9    5.0 N:3 W   3 B W  32 W L  14 B L   9 W W  47 B W  28 W W  19 W
## 10   5.0 N:2 W  25 W L  18 B W  59 W W   8 B W  26 W L   7 B W  20 B
## 11   5.0 N:3 D  16 W L  19 W W  55 B W  31 B D   6 W W  25 B W  18 W
## 12   4.5 N:3 D  38 B W  56 W W   6 B L   7 W L   3 B W  34 W W  26 B
## 13   4.5 N:3 W  42 W W  33 B D   5 W W  38 B      H  D   1 W L   3 B
## 14   4.5 N:3 W  36 B W  27 W L   7 B D   5 B W  33 W L   3 W W  32 B
## 15   4.5 N:3 W  54 W W  44 B W   8 W L   1 W D  27 B L   5 B W  31 W
## 16   4.5 N:3 D  19 B L  16 B W  30 W L  22 W W  54 B W  33 B W  38 W
## 17   4.0 N:3 D  10 B W  15 W      H  W  39 B L   2 W W  36 B      U
## 18   4.0 N:3 W  48 W W  41 B L  26 W L   2 B W  23 W W  22 B L   5 W
## 19   4.0 N:3 W  47 B W   9 W L   1 B W  32 W L  19 B W  38 W L  10 B
## 20   4.0 N:3 D  15 W W  10 B W  52 W D  28 B W  18 W L   4 W L   8 B
## 21   4.0 N:4 L  40 W W  49 B W  23 W W  41 B W  28 W L   2 B L   9 W
## 22   4.0 N:3 W  43 B L   1 W W  47 B L   3 W W  40 W W  39 B L   6 W
## 23   4.0 N:4 W  64 W D  52 B L  28 W W  15 B      H  L  17 W W  40 B
## 24      4.0  L   4 B W  43 W L  20 B W  58 W L  17 B W  37 W W  46 B
## 25   4.0 N:4 L  28 B L  47 W W  43 B L  25 B W  60 W W  44 W W  39 B
## 26   3.5 N:4 L   9 B W  53 W L   3 B W  24 W D  34 B L  10 W W  47 B
## 27   3.5 N:4 W  49 B W  40 W W  17 B L   4 W L   9 B D  32 W L  11 W
## 28   3.5 N:4 W  51 W L  13 B W  46 W W  37 B D  14 W L   6 B      U
## 29   3.5 N:3 W  24 W D   4 W W  22 B D  19 W L  20 B L   8 B D  36 W
## 30   3.5 N:4 W  50 B D   6 W L  38 B L  34 W W  52 W W  48 B      U
## 31      3.5  L  52 W D  64 B L  15 B W  55 W L  31 W W  61 B W  50 B
## 32      3.5  L  58 B D  55 W W  64 B L  10 W W  30 B W  50 W L  14 B
## 33   3.5 N:4 W  61 W L   8 B W  44 W L  18 B W  51 W D  26 B L  13 W
## 34      3.5  W  60 B L  12 W W  50 B D  36 W L  13 B L  15 W W  51 B
## 35      3.5  L   6 B W  60 W L  37 B W  29 B D  25 W L  11 B W  52 W
## 36      3.5  L  46 W L  38 W W  56 B L   6 W W  57 B D  52 B W  48 W
## 37   3.5 N:4 L  13 W W  57 B W  51 W D  33 B      H  L  16 W D  28 B
## 38      3.5       B  L   5 B W  34 W L  27 W      H  L  23 B W  61 W
## 39   3.0 N:4 D  11 W W  35 B W  29 W L  12 W      H  L  18 B L  15 B
## 40   3.0 N:4 L   1 B W  54 W W  40 B L  16 W W  44 B L  21 W L  24 W
## 41      3.0  W  20 B L  26 B L  39 W W  59 W L  21 B W  56 W L  22 W
## 42      3.0  W  59 B L  17 W W  58 B L  20 W      X       U       U
## 43      3.0  L  12 B L  50 W L  57 B D  60 B D  61 W W  64 W W  56 B
## 44      3.0  L  21 W L  23 B L  24 W W  63 W W  59 B L  46 B W  55 W
## 45      3.0       B  L  14 W L  32 B W  53 B L  39 W L  24 B W  59 W
## 46      3.0  L   5 W L  51 B D  60 W L  56 B W  63 W D  55 B W  58 W
## 47      3.0  W  35 B L   7 W L  27 B L  50 W W  64 B W  43 W L  23 W
## 48      2.5  L  18 W W  24 B L  21 W W  61 B L   8 W D  51 B L  25 W
## 49      2.5  L  17 B W  63 W      H  D  52 B      H  L  29 W L  35 B
## 50      2.5  L  26 W L  20 W D  63 B D  64 W W  58 B      H       U
## 51      2.5  L  29 W W  42 B L  33 W W  46 B      H  L  31 B L  30 W
## 52      2.5  L  27 B W  45 W L  36 B W  57 W L  32 B D  47 W L  33 W
## 53   2.5 N:4 W  30 B D  22 W L  19 B D  48 W L  29 B D  35 W L  34 B
## 54      2.0       H  L  25 B      H  L  44 W      U  W  57 W      U
## 55      2.0  L  14 B L  39 B L  61 W      B  L  15 W L  59 B W  64 W
## 56      2.0  L  62 W D  31 B L  10 W L  30 B      B  D  45 W L  43 B
## 57      2.0       H  L  11 B L  35 W W  45 W      H  L  40 B L  42 W
## 58      2.0  L   7 B L  36 W W  42 W L  51 B L  35 W L  53 B      B
## 59      2.0  W  31 W L   2 B L  41 W L  23 B L  49 W      B  L  45 B
## 60      2.0  L  41 W      B  L   9 B L  40 B L  43 W W  54 W L  44 B
## 61      1.5  L  33 W L  34 B D  45 B D  42 W L  24 B      H      U
## 62      1.5  L  32 B L   3 W W  54 B L  47 W D  42 B L  30 W L  37 B
## 63      1.0  W  55 B      U       U       U       U       U       U
## 64      1.0  L   2 W L  48 B D  49 W L  43 B L  45 B      H      U
## 65      1.0  L  22 B D  30 W L  31 W D  49 B L  46 W L  42 B L  54 B
```

b. Get data elements

```
data_elements <-data.frame(str_extract(raw_data_frame$`Pair Num`,'\\d+'), #Player's ID
  str_trim(str_extract(raw_data_frame$`Player Name USCF ID / Rtg (Pre->Post)`,'[A-Z ]+\\b')), #Player's
  str_extract(raw_data_frame$`Pair Num`,'[A-Z]+'), #Player's State
  str_extract(raw_data_frame$`Total Pts`,'[0-9.]+'), #Player's Total Points
  str_replace(raw_data_frame$`Player Name USCF ID / Rtg (Pre->Post)`, '[A-z0-9 [:PUNCT:]]+\\/ R\\: *([0
  lapply(raw_data_frame[,4:10], function(x) str_extract(x, '\\d+'))) #IDs of components

#Rename columns
names(data_elements) <- c('ID','Player’s Name','Player’s State','Total Number of Points','Player’s Pre-

#change data type of 'Player’s Pre-Rating' to be numberic
data_elements$'Player’s Pre-Rating' <- as.numeric(as.character(data_elements$'Player’s Pre-Rating'))

#get ratings of all components for each player
data_elements[,6:12] <- data_elements$'Player’s Pre-Rating'[match(unlist(data_elements[,6:12]),data_ele

#compute average ratings of components for each player
data_elements$'Average Pre Chess Rating of Opponents' <- round(rowMeans(data_elements[,6:12],na.rm = TR
data_elements
```

```
##    ID            Player’s Name Player’s State Total Number of Points
## 1   1                 GARY HUA             ON                    6.0
## 2   2          DAKSHESH DARURI             MI                    6.0
## 3   3             ADITYA BAJAJ             MI                    6.0
## 4   4      PATRICK H SCHILLING             MI                    5.5
## 5   5               HANSHI ZUO             MI                    5.5
## 6   6              HANSEN SONG             OH                    5.0
## 7   7        GARY DEE SWATHELL             MI                    5.0
## 8   8         EZEKIEL HOUGHTON             MI                    5.0
## 9   9              STEFANO LEE             ON                    5.0
## 10 10                ANVIT RAO             MI                    5.0
## 11 11 CAMERON WILLIAM MC LEMAN             MI                    4.5
## 12 12           KENNETH J TACK             MI                    4.5
## 13 13        TORRANCE HENRY JR             MI                    4.5
## 14 14             BRADLEY SHAW             MI                    4.5
## 15 15   ZACHARY JAMES HOUGHTON             MI                    4.5
## 16 16             MIKE NIKITIN             MI                    4.0
## 17 17       RONALD GRZEGORCZYK             MI                    4.0
## 18 18            DAVID SUNDEEN             MI                    4.0
## 19 19             DIPANKAR ROY             MI                    4.0
## 20 20              JASON ZHENG             MI                    4.0
## 21 21            DINH DANG BUI             ON                    4.0
## 22 22         EUGENE L MCCLURE             MI                    4.0
## 23 23                 ALAN BUI             ON                    4.0
## 24 24        MICHAEL R ALDRICH             MI                    4.0
## 25 25         LOREN SCHWIEBERT             MI                    3.5
## 26 26                  MAX ZHU             ON                    3.5
## 27 27           GAURAV GIDWANI             MI                    3.5
## 28 28     SOFIA ADINA STANESCU             MI                    3.5
## 29 29         CHIEDOZIE OKORIE             MI                    3.5
## 30 30       GEORGE AVERY JONES             ON                    3.5
## 31 31             RISHI SHETTY             MI                    3.5
## 32 32    JOSHUA PHILIP MATHEWS             ON                    3.5
## 33 33                  JADE GE             MI                    3.5
## 34 34   MICHAEL JEFFERY THOMAS             MI                    3.5
## 35 35         JOSHUA DAVID LEE             MI                    3.5
## 36 36            SIDDHARTH JHA             MI                    3.5
## 37 37     AMIYATOSH PWNANANDAM             MI                    3.5
## 38 38                BRIAN LIU             MI                    3.0
## 39 39            JOEL R HENDON             MI                    3.0
## 40 40             FOREST ZHANG             MI                    3.0
## 41 41      KYLE WILLIAM MURPHY             MI                    3.0
## 42 42                 JARED GE             MI                    3.0
## 43 43        ROBERT GLEN VASEY             MI                    3.0
## 44 44       JUSTIN D SCHILLING             MI                    3.0
## 45 45                DEREK YAN             MI                    3.0
## 46 46 JACOB ALEXANDER LAVALLEY             MI                    3.0
## 47 47              ERIC WRIGHT             MI                    2.5
## 48 48             DANIEL KHAIN             MI                    2.5
## 49 49         MICHAEL J MARTIN             MI                    2.5
## 50 50               SHIVAM JHA             MI                    2.5
## 51 51           TEJAS AYYAGARI             MI                    2.5
## 52 52                ETHAN GUO             MI                    2.5
## 53 53            JOSE C YBARRA             MI                    2.0
## 54 54              LARRY HODGE             MI                    2.0
## 55 55                ALEX KONG             MI                    2.0
## 56 56             MARISA RICCI             MI                    2.0
## 57 57               MICHAEL LU             MI                    2.0
## 58 58             VIRAJ MOHILE             MI                    2.0
## 59 59        SEAN M MC CORMICK             MI                    2.0
## 60 60               JULIA SHEN             MI                    1.5
## 61 61            JEZZEL FARKAS             ON                    1.5
## 62 62            ASHWIN BALAJI             MI                    1.0
## 63 63     THOMAS JOSEPH HOSMER             MI                    1.0
## 64 64                   BEN LI             MI                    1.0
##    Player’s Pre-Rating Round 1 Round 2 Round 3 Round 4 Round 5 Round 6
## 1                 1794    1436    1563    1600    1610    1649    1663
## 2                 1553    1175     917    1716    1629    1604    1595
## 3                 1384    1641     955    1745    1563    1712    1666
## 4                 1716    1363    1507    1553    1579    1655    1564
## 5                 1655    1242     980    1663    1666    1716    1610
## 6                 1686    1399    1602    1712    1438    1365    1552
## 7                 1649    1092     377    1666    1712    1794    1411
## 8                 1641    1384    1441    1610    1411    1362    1507
## 9                 1411    1745    1600     853    1641    1579    1649
## 10                1365    1604    1564    1186    1494    1686    1745
## 11                1712    1423    1153    1686    1649    1384    1399
## 12                1663    1332    1449    1655    1423      NA    1794
## 13                1666    1355    1552    1649    1655    1449    1384
## 14                1610    1270    1199    1641    1794    1552    1655
## 15                1220    1564    1604    1522    1555    1270    1449
## 16                1604    1365    1220      NA    1436    1553    1355
## 17                1629    1382    1403    1579    1553    1363    1555
## 18                1600    1362    1411    1794    1441    1564    1423
## 19                1564    1220    1365     935    1507    1600    1716
## 20                1595    1348    1291    1363    1403    1507    1553
## 21                1563    1283    1794    1362    1384    1348    1436
## 22                1555    1163     935    1507    1220      NA    1629
## 23                1363    1716    1283    1595     917    1629     980
## 24                1229    1507    1362    1283    1745     967    1199
## 25                1745    1411    1393    1384    1229    1399    1365
## 26                1579    1291    1348    1629    1716    1411    1441
## 27                1552    1011    1666     377     980    1610    1686
## 28                1507    1229    1716    1555    1564    1595    1641
## 29                1602    1056    1686    1423    1399     935    1382
## 30                1522     935    1163    1220    1186    1494     955
## 31                1494     917    1186    1163    1365    1522    1056
## 32                1441     955    1641    1199    1600    1011    1579
## 33                1449     967    1663    1056    1355    1666    1220
## 34                1399    1686     967     980    1602    1745    1712
## 35                1438     377    1423    1153    1686    1092     935
## 36                1355    1666    1092    1011    1449      NA    1604
## 37                 980      NA    1655    1399    1552      NA    1363
## 38                1423    1712    1438    1602    1663      NA    1600
## 39                1436    1794    1270    1348    1604    1199    1563
## 40                1348    1595    1579    1436     853    1563    1153
## 41                1403     853    1629     917    1595      NA      NA
## 42                1332    1663    1056    1092     967     955    1163
## 43                1283    1563    1363    1229    1175     853     377
## 44                1199      NA    1610    1441    1393    1436    1229
## 45                1242    1655    1011     967    1153    1175    1186
## 46                 377    1438    1649    1552    1056    1163    1283
## 47                1362    1600    1229    1563     955    1641    1011
## 48                1382    1629    1175      NA     935      NA    1602
## 49                1291    1579    1595    1175    1163     917      NA
## 50                1056    1602    1332    1449     377      NA    1494
## 51                1011    1552    1242    1355    1092    1441    1362
## 52                 935    1522    1555    1564    1382    1602    1438
## 53                1393      NA    1745      NA    1199      NA    1092
## 54                1270    1610    1436     955      NA    1220     853
## 55                1186    1530    1494    1365    1522      NA    1242
## 56                1153      NA    1712    1438    1242      NA    1348
## 57                1092    1649    1355    1332    1011    1438    1393
## 58                 917    1494    1553    1403    1363    1291      NA
## 59                 853    1403      NA    1411    1348    1283    1270
## 60                 967    1449    1399    1242    1332    1229      NA
## 61                 955    1441    1384    1270    1362    1332    1522
## 62                1530    1186      NA      NA      NA      NA      NA
## 63                1175    1553    1382    1291    1283    1242      NA
## 64                1163    1555    1522    1494    1291     377    1332
##    Round 7 Average Pre Chess Rating of Opponents
## 1     1716                                  1605
## 2     1649                                  1469
## 3     1663                                  1564
## 4     1794                                  1574
## 5     1629                                  1501
## 6     1563                                  1519
## 7     1553                                  1372
## 8     1564                                  1468
## 9     1595                                  1523
## 10    1600                                  1554
## 11    1579                                  1468
## 12    1384                                  1506
## 13    1441                                  1498
## 14    1494                                  1515
## 15    1423                                  1484
## 16      NA                                  1386
## 17    1655                                  1499
## 18    1365                                  1480
## 19    1641                                  1426
## 20    1411                                  1411
## 21    1686                                  1470
## 22    1348                                  1300
## 23     377                                  1214
## 24    1436                                  1357
## 25    1362                                  1363
## 26    1712                                  1507
## 27      NA                                  1222
## 28    1355                                  1522
## 29      NA                                  1314
## 30    1056                                  1144
## 31    1610                                  1260
## 32    1666                                  1379
## 33    1011                                  1277
## 34     935                                  1375
## 35    1382                                  1150
## 36    1507                                  1388
## 37     955                                  1385
## 38    1220                                  1539
## 39    1229                                  1430
## 40    1555                                  1391
## 41      NA                                  1248
## 42    1153                                  1150
## 43    1186                                  1107
## 44     853                                  1327
## 45     917                                  1152
## 46    1363                                  1358
## 47    1745                                  1392
## 48    1438                                  1356
## 49      NA                                  1286
## 50    1522                                  1296
## 51    1449                                  1356
## 52    1399                                  1495
## 53      NA                                  1345
## 54    1163                                  1206
## 55    1283                                  1406
## 56    1332                                  1414
## 57      NA                                  1363
## 58    1242                                  1391
## 59    1199                                  1319
## 60      NA                                  1330
## 61     980                                  1327
## 62      NA                                  1186
## 63      NA                                  1350
## 64    1270                                  1263
```

3. Present final data

```
final_data <- subset(data_elements[,c(2:5,13)])
final_data
```

```
##               Player’s Name Player’s State Total Number of Points
## 1                  GARY HUA             ON                    6.0
## 2           DAKSHESH DARURI             MI                    6.0
## 3              ADITYA BAJAJ             MI                    6.0
## 4       PATRICK H SCHILLING             MI                    5.5
## 5                HANSHI ZUO             MI                    5.5
## 6               HANSEN SONG             OH                    5.0
## 7         GARY DEE SWATHELL             MI                    5.0
## 8          EZEKIEL HOUGHTON             MI                    5.0
## 9               STEFANO LEE             ON                    5.0
## 10                ANVIT RAO             MI                    5.0
## 11 CAMERON WILLIAM MC LEMAN             MI                    4.5
## 12           KENNETH J TACK             MI                    4.5
## 13        TORRANCE HENRY JR             MI                    4.5
## 14             BRADLEY SHAW             MI                    4.5
## 15   ZACHARY JAMES HOUGHTON             MI                    4.5
## 16             MIKE NIKITIN             MI                    4.0
## 17       RONALD GRZEGORCZYK             MI                    4.0
## 18            DAVID SUNDEEN             MI                    4.0
## 19             DIPANKAR ROY             MI                    4.0
## 20              JASON ZHENG             MI                    4.0
## 21            DINH DANG BUI             ON                    4.0
## 22         EUGENE L MCCLURE             MI                    4.0
## 23                 ALAN BUI             ON                    4.0
## 24        MICHAEL R ALDRICH             MI                    4.0
## 25         LOREN SCHWIEBERT             MI                    3.5
## 26                  MAX ZHU             ON                    3.5
## 27           GAURAV GIDWANI             MI                    3.5
## 28     SOFIA ADINA STANESCU             MI                    3.5
## 29         CHIEDOZIE OKORIE             MI                    3.5
## 30       GEORGE AVERY JONES             ON                    3.5
## 31             RISHI SHETTY             MI                    3.5
## 32    JOSHUA PHILIP MATHEWS             ON                    3.5
## 33                  JADE GE             MI                    3.5
## 34   MICHAEL JEFFERY THOMAS             MI                    3.5
## 35         JOSHUA DAVID LEE             MI                    3.5
## 36            SIDDHARTH JHA             MI                    3.5
## 37     AMIYATOSH PWNANANDAM             MI                    3.5
## 38                BRIAN LIU             MI                    3.0
## 39            JOEL R HENDON             MI                    3.0
## 40             FOREST ZHANG             MI                    3.0
## 41      KYLE WILLIAM MURPHY             MI                    3.0
## 42                 JARED GE             MI                    3.0
## 43        ROBERT GLEN VASEY             MI                    3.0
## 44       JUSTIN D SCHILLING             MI                    3.0
## 45                DEREK YAN             MI                    3.0
## 46 JACOB ALEXANDER LAVALLEY             MI                    3.0
## 47              ERIC WRIGHT             MI                    2.5
## 48             DANIEL KHAIN             MI                    2.5
## 49         MICHAEL J MARTIN             MI                    2.5
## 50               SHIVAM JHA             MI                    2.5
## 51           TEJAS AYYAGARI             MI                    2.5
## 52                ETHAN GUO             MI                    2.5
## 53            JOSE C YBARRA             MI                    2.0
## 54              LARRY HODGE             MI                    2.0
## 55                ALEX KONG             MI                    2.0
## 56             MARISA RICCI             MI                    2.0
## 57               MICHAEL LU             MI                    2.0
## 58             VIRAJ MOHILE             MI                    2.0
## 59        SEAN M MC CORMICK             MI                    2.0
## 60               JULIA SHEN             MI                    1.5
## 61            JEZZEL FARKAS             ON                    1.5
## 62            ASHWIN BALAJI             MI                    1.0
## 63     THOMAS JOSEPH HOSMER             MI                    1.0
## 64                   BEN LI             MI                    1.0
##    Player’s Pre-Rating Average Pre Chess Rating of Opponents
## 1                 1794                                  1605
## 2                 1553                                  1469
## 3                 1384                                  1564
## 4                 1716                                  1574
## 5                 1655                                  1501
## 6                 1686                                  1519
## 7                 1649                                  1372
## 8                 1641                                  1468
## 9                 1411                                  1523
## 10                1365                                  1554
## 11                1712                                  1468
## 12                1663                                  1506
## 13                1666                                  1498
## 14                1610                                  1515
## 15                 1220                                   1484
## 16                 1604                                   1386
## 17                 1629                                   1499
## 18                 1600                                   1480
## 19                 1564                                   1426
## 20                 1595                                   1411
## 21                 1563                                   1470
## 22                 1555                                   1300
## 23                 1363                                   1214
## 24                 1229                                   1357
## 25                 1745                                   1363
## 26                 1579                                   1507
## 27                 1552                                   1222
## 28                 1507                                   1522
## 29                 1602                                   1314
## 30                 1522                                   1144
## 31                 1494                                   1260
## 32                 1441                                   1379
## 33                 1449                                   1277
## 34                 1399                                   1375
## 35                 1438                                   1150
## 36                 1355                                   1388
## 37                  980                                   1385
## 38                 1423                                   1539
## 39                 1436                                   1430
## 40                 1348                                   1391
## 41                 1403                                   1248
## 42                 1332                                   1150
## 43                 1283                                   1107
## 44                 1199                                   1327
## 45                 1242                                   1152
## 46                  377                                   1358
## 47                 1362                                   1392
## 48                 1382                                   1356
## 49                 1291                                   1286
## 50                 1056                                   1296
## 51                 1011                                   1356
## 52                  935                                   1495
## 53                 1393                                   1345
## 54                 1270                                   1206
## 55                 1186                                   1406
## 56                 1153                                   1414
## 57                 1092                                   1363
## 58                  917                                   1391
## 59                  853                                   1319
## 60                  967                                   1330
## 61                  955                                   1327
## 62                 1530                                   1186
## 63                 1175                                   1350
## 64                 1163                                   1263
```

4. Save Final Data as CSV

```
write.csv(final_data, 'Final_data.csv', row.names = FALSE)

# Let's check the csv output, looks good:)
read.csv('Final_data.csv')
```

```
##               Player.s.Name Player.s.State Total.Number.of.Points
## 1                  GARY HUA             ON                    6.0
## 2           DAKSHESH DARURI             MI                    6.0
## 3              ADITYA BAJAJ             MI                    6.0
## 4       PATRICK H SCHILLING             MI                    5.5
## 5                HANSHI ZUO             MI                    5.5
## 6               HANSEN SONG             OH                    5.0
## 7         GARY DEE SWATHELL             MI                    5.0
## 8          EZEKIEL HOUGHTON             MI                    5.0
## 9               STEFANO LEE             ON                    5.0
## 10                ANVIT RAO             MI                    5.0
## 11 CAMERON WILLIAM MC LEMAN             MI                    4.5
## 12           KENNETH J TACK             MI                    4.5
## 13        TORRANCE HENRY JR             MI                    4.5
## 14             BRADLEY SHAW             MI                    4.5
## 15   ZACHARY JAMES HOUGHTON             MI                    4.5
## 16             MIKE NIKITIN             MI                    4.0
## 17       RONALD GRZEGORCZYK             MI                    4.0
## 18            DAVID SUNDEEN             MI                    4.0
## 19             DIPANKAR ROY             MI                    4.0
## 20              JASON ZHENG             MI                    4.0
## 21            DINH DANG BUI             ON                    4.0
## 22         EUGENE L MCCLURE             MI                    4.0
## 23                 ALAN BUI             ON                    4.0
## 24        MICHAEL R ALDRICH             MI                    4.0
## 25         LOREN SCHWIEBERT             MI                    3.5
## 26                  MAX ZHU             ON                    3.5
## 27           GAURAV GIDWANI             MI                    3.5
## 28     SOFIA ADINA STANESCU             MI                    3.5
## 29         CHIEDOZIE OKORIE             MI                    3.5
## 30       GEORGE AVERY JONES             ON                    3.5
## 31             RISHI SHETTY             MI                    3.5
## 32    JOSHUA PHILIP MATHEWS             ON                    3.5
## 33                  JADE GE             MI                    3.5
## 34   MICHAEL JEFFERY THOMAS             MI                    3.5
## 35         JOSHUA DAVID LEE             MI                    3.5
## 36            SIDDHARTH JHA             MI                    3.5
## 37     AMIYATOSH PWNANANDAM             MI                    3.5
## 38                BRIAN LIU             MI                    3.0
## 39            JOEL R HENDON             MI                    3.0
## 40             FOREST ZHANG             MI                    3.0
## 41      KYLE WILLIAM MURPHY             MI                    3.0
## 42                 JARED GE             MI                    3.0
## 43        ROBERT GLEN VASEY             MI                    3.0
## 44       JUSTIN D SCHILLING             MI                    3.0
## 45                DEREK YAN             MI                    3.0
## 46 JACOB ALEXANDER LAVALLEY             MI                    3.0
## 47              ERIC WRIGHT             MI                    2.5
## 48             DANIEL KHAIN             MI                    2.5
## 49         MICHAEL J MARTIN             MI                    2.5
## 50               SHIVAM JHA             MI                    2.5
## 51           TEJAS AYYAGARI             MI                    2.5
## 52                ETHAN GUO             MI                    2.5
## 53            JOSE C YBARRA             MI                    2.0
## 54              LARRY HODGE             MI                    2.0
## 55                ALEX KONG             MI                    2.0
## 56             MARISA RICCI             MI                    2.0
## 57               MICHAEL LU             MI                    2.0
## 58             VIRAJ MOHILE             MI                    2.0
## 59        SEAN M MC CORMICK             MI                    2.0
## 60               JULIA SHEN             MI                    1.5
## 61            JEZZEL FARKAS             ON                    1.5
## 62            ASHWIN BALAJI             MI                    1.0
## 63     THOMAS JOSEPH HOSMER             MI                    1.0
## 64                   BEN LI             MI                    1.0
##    Player.s.Pre.Rating Average.Pre.Chess.Rating.of.Opponents
## 1                 1794                                  1605
## 2                 1553                                  1469
## 3                 1384                                  1564
## 4                 1716                                  1574
## 5                 1655                                  1501
## 6                 1686                                  1519
## 7                 1649                                  1372
## 8                 1641                                  1468
## 9                 1411                                  1523
## 10                1365                                  1554
## 11                1712                                  1468
## 12                1663                                  1506
## 13                1666                                  1498
## 14                1610                                  1515
## 15                1220                                  1484
## 16                1604                                  1386
## 17                1629                                  1499
## 18                1600                                  1480
## 19                1564                                  1426
## 20                1595                                  1411
## 21                1563                                  1470
## 22                1555                                  1300
## 23                1363                                  1214
## 24                1229                                  1357
## 25                1745                                  1363
## 26                1579                                  1507
## 27                1552                                  1222
## 28                1507                                  1522
## 29                1602                                  1314
## 30                1522                                  1144
## 31                1494                                  1260
## 32                1441                                  1379
## 33                1449                                  1277
## 34                 1399                                  1375
## 35                 1438                                  1150
## 36                 1355                                  1388
## 37                  980                                  1385
## 38                 1423                                  1539
## 39                 1436                                  1430
## 40                 1348                                  1391
## 41                 1403                                  1248
## 42                 1332                                  1150
## 43                 1283                                  1107
## 44                 1199                                  1327
## 45                 1242                                  1152
## 46                  377                                  1358
## 47                 1362                                  1392
## 48                 1382                                  1356
## 49                 1291                                  1286
## 50                 1056                                  1296
## 51                 1011                                  1356
## 52                  935                                  1495
## 53                 1393                                  1345
## 54                 1270                                  1206
## 55                 1186                                  1406
## 56                 1153                                  1414
## 57                 1092                                  1363
## 58                  917                                  1391
## 59                  853                                  1319
## 60                  967                                  1330
## 61                  955                                  1327
## 62                 1530                                  1186
## 63                 1175                                  1350
## 64                 1163                                  1263
```

5. Extra Data Analysis

It is fun and challenge in a chess tournament where players are paried according to a certain rating algorithm which matches players with compatible components, which means if a player has high winning rate, he/she will be more likely to paired with a strong component in the next run. Let's see if this is the case in this data set.

```
library(reshape2)
```

```
##
## Attaching package: 'reshape2'
```

```
## The following object is masked from 'package:tidyr':
##
##     smiths
```

```
# extract a new subset of data which records results of each round, then compute the wining-rate of eac
data <- data.frame(lapply(raw_data_frame[,c(2,4:10)], function(x) str_trim(str_extract(str_trim(x),'^[A
# For a more accurate winning-rate, in this data set only players who completed all 7 rounds of game ar
data <-na.omit(data)
names(data)<-c('Name', str_c('Round_', c(1:7)))
data
```

```
##                         Name Round_1 Round_2 Round_3 Round_4 Round_5
## 1                   GARY HUA       W       W       W       W       W
## 2            DAKSHESH DARURI       W       W       L       W       W
## 3               ADITYA BAJAJ       L       W       W       W       W
## 4        PATRICK H SCHILLING       W       D       W       W       D
## 5                HANSHI ZUO        W       W       D       D       D
## 6                HANSEN SONG       W       D       L       W       D
## 7          GARY DEE SWATHELL       W       W       W       W       L
## 8           EZEKIEL HOUGHTON       W       W       L       L       W
## 9                STEFANO LEE       W       L       W       W       W
## 10                 ANVIT RAO       D       L       W       W       D
## 11 CAMERON WILLIAM MC LEMAN       D       W       W       L       L
## 13         TORRANCE HENRY JR       W       W       L       D       W
## 14              BRADLEY SHAW       W       W       W       L       D
## 15    ZACHARY JAMES HOUGHTON       D       L       W       L       W
## 17        RONALD GRZEGORCZYK       W       W       L       L       W
## 18             DAVID SUNDEEN       W       W       L       W       L
## 19              DIPANKAR ROY       D       W       W       D       W
## 20               JASON ZHENG       L       W       W       W       W
## 21             DINH DANG BUI       W       L       W       L       W
## 23                  ALAN BUI       L       W       L       W       L
## 24         MICHAEL R ALDRICH       L       L       W       L       W
## 25          LOREN SCHWIEBERT       L       W       L       W       D
## 26                   MAX ZHU       W       W       W       L       L
## 28      SOFIA ADINA STANESCU       W       D       W       D       L
## 30        GEORGE AVERY JONES       L       D       L       W       L
## 31              RISHI SHETTY       L       D       W       L       W
## 32     JOSHUA PHILIP MATHEWS       W       L       W       L       W
## 33                   JADE GE       W       L       W       D       L
## 34    MICHAEL JEFFERY THOMAS       L       W       L       W       D
## 35          JOSHUA DAVID LEE       L       L       W       L       W
## 39             JOEL R HENDON       L       W       W       L       W
## 40              FOREST ZHANG       W       L       L       W       L
## 42                  JARED GE       L       L       L       D       D
## 43         ROBERT GLEN VASEY       L       L       L       W       W
## 45                 DEREK YAN       L       L       D       L       W
## 46 JACOB ALEXANDER LAVALLEY       W       L       L       L       W
## 47               ERIC WRIGHT       L       W       L       W       L
## 51             TEJAS AYYAGARI      L       W       L       W       L
## 52                 ETHAN GUO       W       D       L       D       L
## 61            JEZZEL FARKAS        L       L       W       L       D
## 64                    BEN LI       L       D       L       D       L
##    Round_6 Round_7
## 1        D       D
## 2        W       W
## 3        W       W
## 4        W       D
## 5        W       W
## 6        W       W
## 7         W       L
## 8         W       W
## 9         L       W
## 10        W       W
## 11        W       W
## 13        L       W
## 14        L       W
## 15        W       W
## 17        W       L
## 18        W       L
## 19        L       L
## 20        L       L
## 21        W       L
## 23        W       W
## 24        W       W
## 25        L       W
## 26        D       L
## 28        L       D
## 30        W       W
## 31        W       L
## 32        D       L
## 33        L       W
## 34        L       W
## 35        D       W
## 39        L       L
## 40        W       L
## 42        W       W
## 43        L       W
## 45        D       W
## 46        W       L
## 47        D       L
## 51        D       L
## 52        D       L
## 61        L       L
## 64        L       L
```

```
# Reshape the data and compute winning-rate
data_melt <- melt(data, variable.name = 'Round', value.name = 'Result', id.vars = c('Name'))
data_cast <- dcast(data_melt, Name~Result, fun.aggregate = length)
```

```
## Using Result as value column: use value.var to override.
```

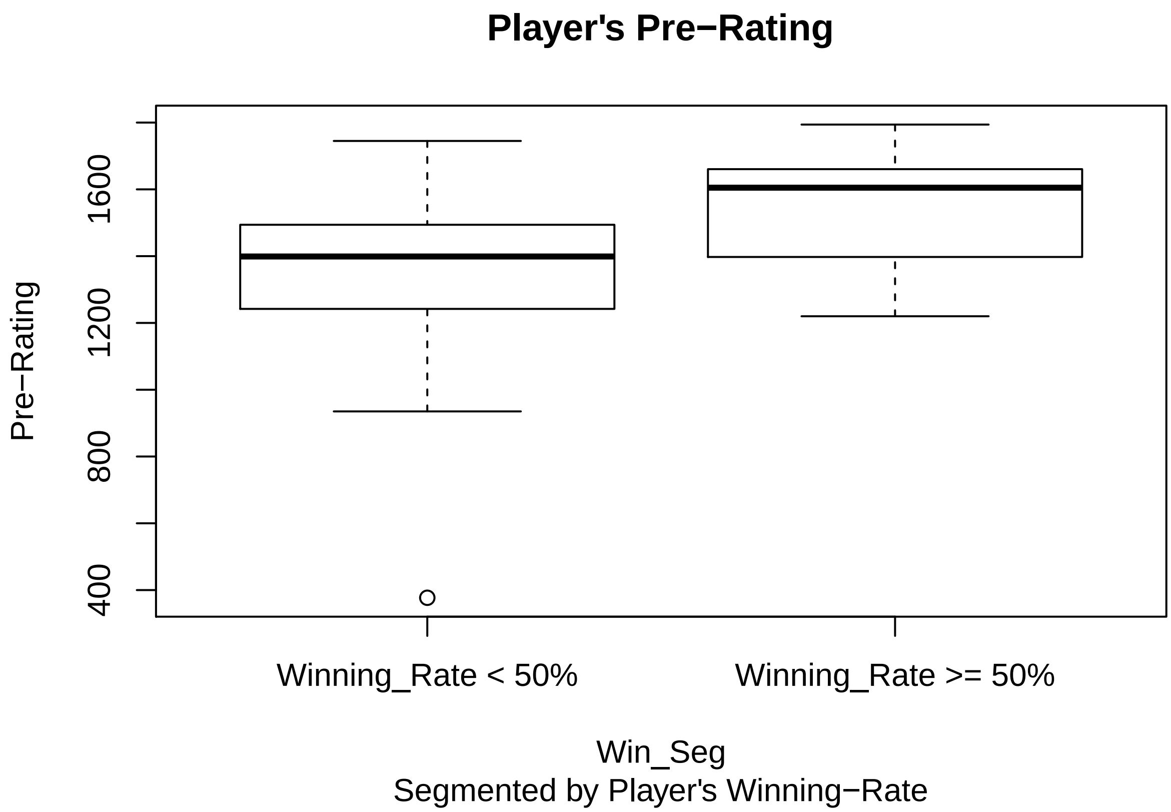
```
data_cast$Win_Rtg <-data_cast$W/7

# Join the final_data set in previous section
data_join <-merge(data_cast,final_data,by.x=c('Name'),by.y=c('Player’s Name'))
data_join$Rtg_Diff <- data_join[,9]-data_join[,8]
data_join$Win_Seg <-ifelse(data_join$Win_Rtg>=0.5, 'Winning_Rate >= 50%', 'Winning_Rate < 50%')
data_join
```

```
##                        Name D L W   Win_Rtg Player’s State
## 1              ADITYA BAJAJ 0 1 6 0.8571429             MI
## 2                  ALAN BUI 0 3 4 0.5714286             ON
## 3                 ANVIT RAO 2 1 4 0.5714286             MI
## 4                    BEN LI 2 5 0 0.0000000             MI
## 5              BRADLEY SHAW 1 2 4 0.5714286             MI
## 6  CAMERON WILLIAM MC LEMAN 1 2 4 0.5714286             MI
## 7           DAKSHESH DARURI 0 1 6 0.8571429             MI
## 8             DAVID SUNDEEN 0 3 4 0.5714286             MI
## 9                 DEREK YAN 2 3 2 0.2857143             MI
## 10            DINH DANG BUI 0 3 4 0.5714286             ON
## 11             DIPANKAR ROY 2 2 3 0.4285714             MI
## 12              ERIC WRIGHT 1 4 2 0.2857143             MI
## 13                ETHAN GUO 3 3 1 0.1428571             MI
## 14         EZEKIEL HOUGHTON 0 2 5 0.7142857             MI
## 15             FOREST ZHANG 0 4 3 0.4285714             MI
## 16        GARY DEE SWATHELL 0 2 5 0.7142857             MI
## 17                 GARY HUA 2 0 5 0.7142857             ON
## 18       GEORGE AVERY JONES 1 3 3 0.4285714             ON
## 19              HANSEN SONG 2 1 4 0.5714286             OH
## 20               HANSHI ZUO 3 0 4 0.5714286             MI
## 21 JACOB ALEXANDER LAVALLEY 0 4 3 0.4285714             MI
## 22                  JADE GE 1 3 3 0.4285714             MI
## 23                 JARED GE 2 3 2 0.2857143             MI
## 24              JASON ZHENG 0 3 4 0.5714286             MI
## 25            JEZZEL FARKAS 1 5 1 0.1428571             ON
## 26            JOEL R HENDON 0 4 3 0.4285714             MI
## 27         JOSHUA DAVID LEE 1 3 3 0.4285714             MI
## 28    JOSHUA PHILIP MATHEWS 1 3 3 0.4285714             ON
## 29         LOREN SCHWIEBERT 1 3 3 0.4285714             MI
## 30                  MAX ZHU 1 3 3 0.4285714             ON
## 31   MICHAEL JEFFERY THOMAS 1 3 3 0.4285714             MI
## 32        MICHAEL R ALDRICH 0 3 4 0.5714286             MI
## 33      PATRICK H SCHILLING 3 0 4 0.5714286             MI
## 34             RISHI SHETTY 1 3 3 0.4285714             MI
## 35        ROBERT GLEN VASEY 0 4 3 0.4285714             MI
## 36       RONALD GRZEGORCZYK 0 3 4 0.5714286             MI
## 37     SOFIA ADINA STANESCU 3 2 2 0.2857143             MI
## 38              STEFANO LEE 0 2 5 0.7142857             ON
## 39           TEJAS AYYAGARI 1 4 2 0.2857143             MI
## 40        TORRANCE HENRY JR 1 2 4 0.5714286             MI
## 41   ZACHARY JAMES HOUGHTON 1 2 4 0.5714286             MI
##    Total Number of Points Player’s Pre-Rating
## 1                     6.0                1384
## 2                     4.0                1363
## 3                     5.0                1365
## 4                     1.0                1163
## 5                     4.5                1610
## 6                     4.5                1712
## 7                     6.0                1553
## 8                     4.0                1600
## 9                     3.0                1242
## 10                    4.0                1563
## 11                    4.0                1564
## 12                    2.5                1362
## 13                    2.5                 935
## 14                    5.0                1641
## 15                    3.0                1348
## 16                    5.0                1649
## 17                    6.0                1794
## 18                    3.5                1522
## 19                    5.0                1686
## 20                    5.5                1655
## 21                    3.0                 377
## 22                    3.5                1449
## 23                    3.0                1332
## 24                    4.0                1595
## 25                    1.5                 955
## 26                    3.0                1436
## 27                    3.5                1438
## 28                    3.5                1441
## 29                    3.5                1745
## 30                    3.5                1579
## 31                    3.5                1399
## 32                    4.0                1229
## 33                    5.5                1716
## 34                    3.5                1494
## 35                    3.0                1283
## 36                    4.0                1629
## 37                    3.5                1507
## 38                    5.0                1411
## 39                    2.5                1011
## 40                    4.5                1666
## 41                    4.5                1220
##    Average Pre Chess Rating of Opponents Rtg_Diff              Win_Seg
## 1                                   1564      180 Winning_Rate >= 50%
## 2                                   1214     -149 Winning_Rate >= 50%
## 3                                   1554      189 Winning_Rate >= 50%
## 4                                   1263      100  Winning_Rate < 50%
## 5                                   1515      -95 Winning_Rate >= 50%
## 6                                   1468     -244 Winning_Rate >= 50%
## 7                                   1469      -84 Winning_Rate >= 50%
## 8                                   1480     -120 Winning_Rate >= 50%
## 9                                   1152      -90  Winning_Rate < 50%
## 10                                  1470      -93 Winning_Rate >= 50%
## 11                                  1426     -138  Winning_Rate < 50%
## 12                                  1392       30  Winning_Rate < 50%
## 13                                  1495      560  Winning_Rate < 50%
## 14                                  1468     -173 Winning_Rate >= 50%
## 15                                  1391       43  Winning_Rate < 50%
## 16                                  1372     -277 Winning_Rate >= 50%
## 17                                  1605     -189 Winning_Rate >= 50%
## 18                                  1144     -378  Winning_Rate < 50%
## 19                                  1519     -167 Winning_Rate >= 50%
## 20                                  1501     -154 Winning_Rate >= 50%
## 21                                  1358      981  Winning_Rate < 50%
## 22                                  1277     -172  Winning_Rate < 50%
## 23                                  1150     -182  Winning_Rate < 50%
## 24                                  1411     -184 Winning_Rate >= 50%
## 25                                  1327      372  Winning_Rate < 50%
## 26                                  1430       -6  Winning_Rate < 50%
## 27                                  1150     -288  Winning_Rate < 50%
## 28                                  1379      -62  Winning_Rate < 50%
## 29                                  1363     -382  Winning_Rate < 50%
## 30                                  1507      -72  Winning_Rate < 50%
## 31                                  1375      -24  Winning_Rate < 50%
## 32                                  1357      128 Winning_Rate >= 50%
## 33                                  1574     -142 Winning_Rate >= 50%
## 34                                  1260     -234  Winning_Rate < 50%
## 35                                  1107     -176  Winning_Rate < 50%
## 36                                  1499     -130 Winning_Rate >= 50%
## 37                                  1522       15  Winning_Rate < 50%
## 38                                  1523      112 Winning_Rate >= 50%
## 39                                  1356      345  Winning_Rate < 50%
## 40                                  1498     -168 Winning_Rate >= 50%
## 41                                  1484      264 Winning_Rate >= 50%
```

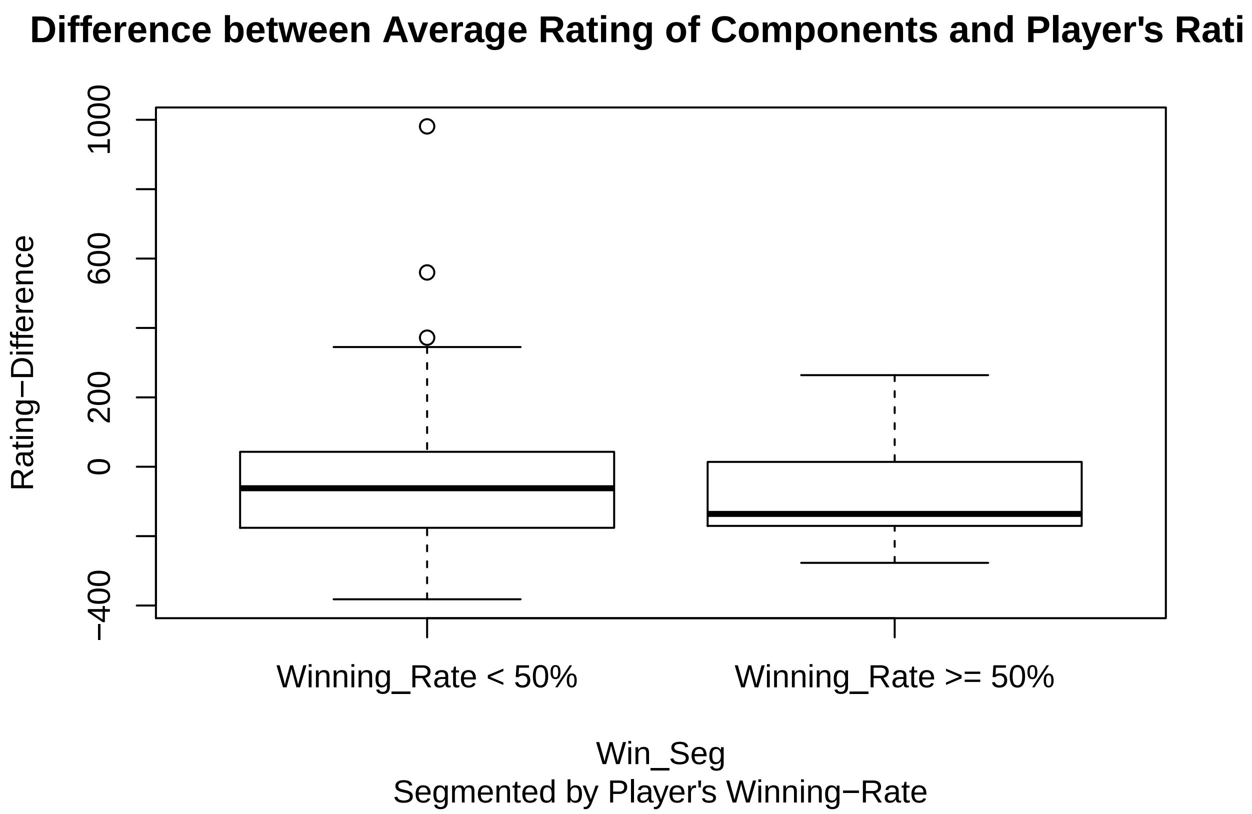
A player who has high wining rate always has high rating. This can be shown in the boxplot below.

```
boxplot(data_join$"Player’s Pre-Rating"~Win_Seg, data=data_join, main="Player's Pre-Rating",
        sub="Segmented by Player's Winning-Rate", ylab = 'Pre-Rating')
```



The second boxplot below shows that players with low winning rates have wider range of components in terms of the rating of components, while players with high wining rates are more likely to be paired components with equal or close ratings. combine with the observation in the first boxplot above, players with high wining rates always have higher ratings, we can see that the more games the player win, the higher his/her rating is, and the more likely he/she will pair with components of similar high level.

```r
boxplot(Rtg_Diff~Win_Seg, data=data_join,
        main="Difference between Average Rating of Components and Player's Rating",
        sub="Segmented by Player's Winning-Rate", ylab = 'Rating-Difference')
```


Difference between Average Rating of Components and Player's Rati
Rating−Difference
Winning_Rate < 50%
Winning_Rate >= 50%
Win_Seg
Segmented by Player's Winning−Rate