

Week 2.3 - Summary Statistics and Correlation Analysis

Import Updated NBA Game Data

```
library(tidyverse)

## -- Attaching packages ----- tidyverse 1.3.0 --
## v ggplot2 3.3.2      v purrr 0.3.4
## v tibble 3.0.3       v dplyr 1.0.0
## v tidyr 1.1.0        v stringr 1.4.0
## v readr 1.3.1        v forcats 0.5.0

## -- Conflicts ----- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()     masks stats::lag()

library(gridExtra)

##
## Attaching package: 'gridExtra'
##
## The following object is masked from 'package:dplyr':
##
##   combine

library(lubridate)

##
## Attaching package: 'lubridate'
##
## The following objects are masked from 'package:base':
##
##   date, intersect, setdiff, union

NBA_Games = read.csv("~/Google Drive/Sports Analytics Moocs/MOOC 1 - Foundations of sports analytics/Week 2.3 - Summary Statistics and Correlation Analysis/NBA Games.csv")
head(NBA_Games)
```

	CITY	TEAM_NAME	TEAM_ID	NICKNAME	STATE	YEAR_FOUNDED	SEASON_ID								
## 1	Atlanta	Atlanta Hawks	1610612737	Hawks	Atlanta	1949	22019								
## 2	Atlanta	Atlanta Hawks	1610612737	Hawks	Atlanta	1949	22019								
## 3	Atlanta	Atlanta Hawks	1610612737	Hawks	Atlanta	1949	22019								
## 4	Atlanta	Atlanta Hawks	1610612737	Hawks	Atlanta	1949	22019								
## 5	Atlanta	Atlanta Hawks	1610612737	Hawks	Atlanta	1949	22019								
## 6	Atlanta	Atlanta Hawks	1610612737	Hawks	Atlanta	1949	22018								
##	TEAM_ABBREVIATION	GAME_ID	GAME_DATE	MATCHUP	WL	MIN	PTS	FGM	FGA	FG_PCT					
## 1	ATL	1521900072	2019-07-12	ATL @ SAS	W	201	80	27	79	0.342					
## 2	ATL	1521900060	2019-07-11	ATL @ WAS	L	200	71	26	68	0.382					
## 3	ATL	1521900042	2019-07-09	ATL vs. IND	W	202	87	31	60	0.517					
## 4	ATL	1521900023	2019-07-07	ATL vs. MIN	L	178	60	18	62	0.290					
## 5	ATL	1521900013	2019-07-06	ATL @ MIL	L	201	83	25	73	0.342					
## 6	ATL	21801220	2019-04-10	ATL vs. IND	L	240	134	43	103	0.417					
##	FG3M	FG3A	FG3_PCT	FTM	FTA	FT_PCT	OREB	DREB	REB	AST	STL	BLK	TOV	PF	PLUS_MINUS

```
## 1 9 32 0.281 17 20 0.850 13 23 36 14 15 3 12 24 8.0
## 2 12 29 0.414 7 10 0.700 9 28 37 19 10 8 22 25 -5.0
## 3 8 21 0.381 17 24 0.708 7 27 34 17 5 5 18 21 18.2
## 4 4 22 0.182 20 32 0.625 9 27 36 7 7 10 18 28 -24.0
## 5 10 32 0.313 23 26 0.885 9 30 39 13 11 6 13 21 2.0
## 6 17 41 0.415 31 38 0.816 22 39 61 29 5 7 17 25 -1.0
## WIN
## 1 1
## 2 0
## 3 1
## 4 0
## 5 0
## 6 0
```

More on Summary Statistics

Central Tendency vs. Variation

We will compare the success rates of two-point field goals and three-point field goals to demonstrate the difference between central tendency and variation.

Calculate summary statistics for the percentages of two-point field goals and three-point field goals

- Two-point field goals

```
summary(NBA_Games$FG_PCT)
```

```
##      Min. 1st Qu.  Median      Mean 3rd Qu.      Max.
## 0.2170 0.4140 0.4520 0.4525 0.4890 0.6840
```

```
sd(NBA_Games$FG_PCT)
```

```
## [1] 0.05643599
```

- Three-point field goals

```
summary(NBA_Games$FG3_PCT)
```

```
##      Min. 1st Qu.  Median      Mean 3rd Qu.      Max.
## 0.0000 0.2860 0.3490 0.3506 0.4170 0.8420
```

```
sd(NBA_Games$FG3_PCT)
```

```
## [1] 0.09947898
```

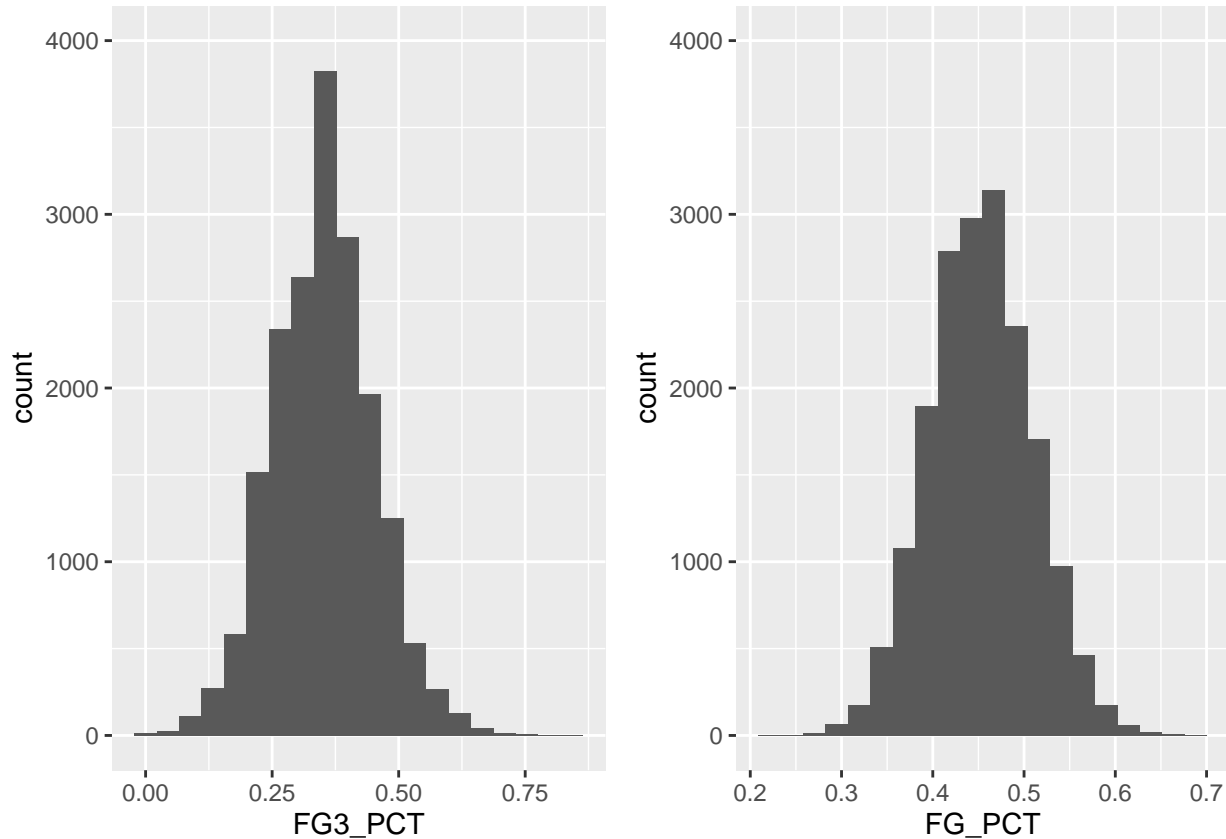
We can see that the average success rate of 2-point field goals is about 45.27% while the average success rate of 3-point field goals is 35.07%. That means that the overall success rate of 2-point field goals is about 10% higher than the overall success rate of 3-point field goals. The median of 2-point field goal success rate is 45.20%, while the median 3-point field goal success rate is 35.00%. This means half of the teams have 2-point field-goal success rates less than 45% and half of the teams have 3-point field goal success rate of less than 35%.

The standard deviation for 2-point field goal success rate is 0.056, while the standard deviation for 3-point field goal success rate is 0.09956. This means that there is a greater variation in 3-point field goals than 2-point field goals.

Compare the distribution of two-point field goal percentage and three-point field goal percentage using a Histogram

Plot two histograms side by side The options “`scale_x_continuous`” and “`scale_y_continuous`” can be used to restrict the same range of *x* and same range of *y* for the two histograms

```
p1 <- ggplot(NBA_Games, aes(x=FG3_PCT)) +  
  geom_histogram(bins=20) + scale_y_continuous(limits = c(0, 4000))  
p2 <- ggplot(NBA_Games, aes(x=FG_PCT)) +  
  geom_histogram(bins=20) + scale_y_continuous(limits = c(0, 4000))  
  
grid.arrange(p1,p2,ncol=2)
```

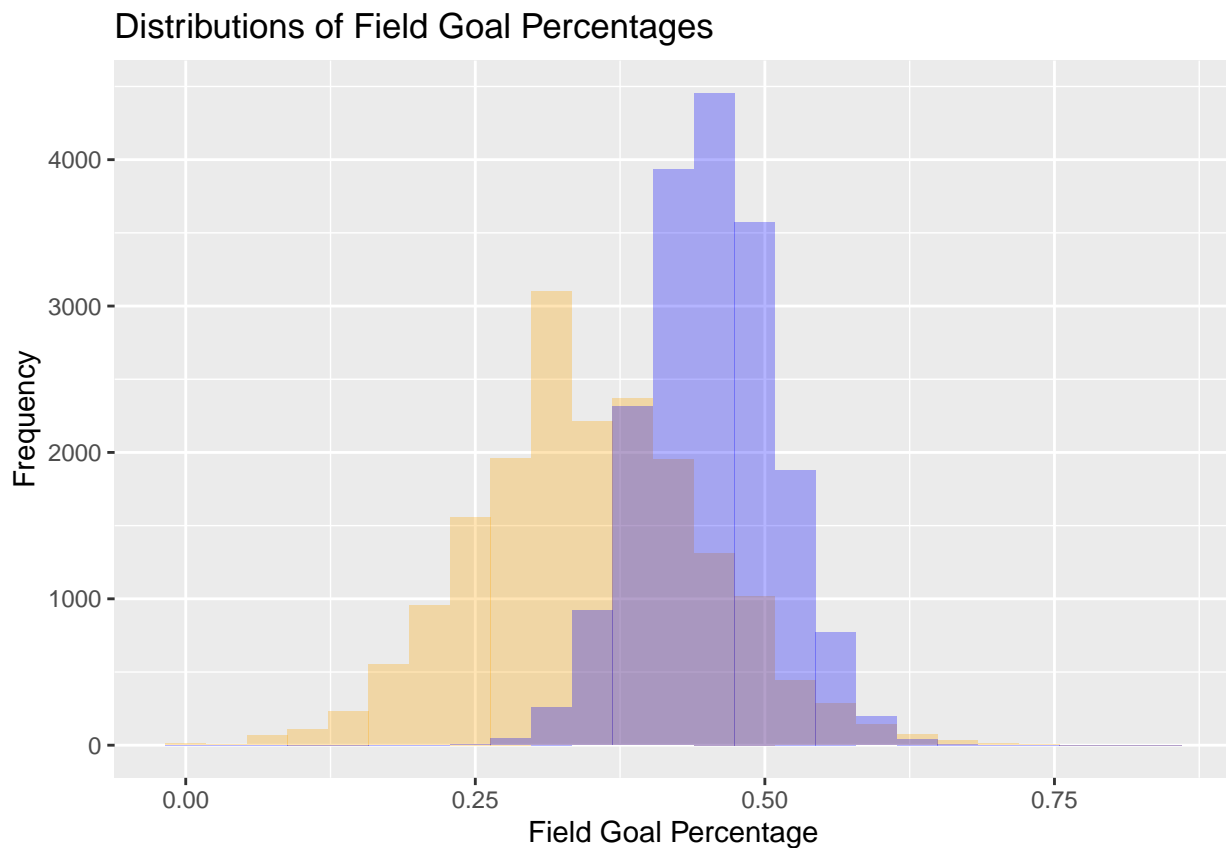


Plot two histograms in the same graph in different colors

We will first introduce a new library “ggplot2” that provides more useful functions to make plots.

- The option “alpha” specifies transparency, so that the two histograms would not block each other entirely (alpha=0: fully transparent; alpha=1: fully opaque)
- We can also add a title and axis labels using the “labs” command
- We can change the color of the histograms by using the “fill” option
- We can also export the graph as a png file using the “ggsave” command

```
ggplot(NBA_Games) +  
  geom_histogram(aes(x=FG3_PCT), bins = 25, alpha = 0.3, fill='orange') +  
  geom_histogram(aes(x=FG_PCT), bins = 25, alpha = 0.3, fill = 'blue') +  
  labs(title="Distributions of Field Goal Percentages",  
       x = "Field Goal Percentage", y = "Frequency")
```

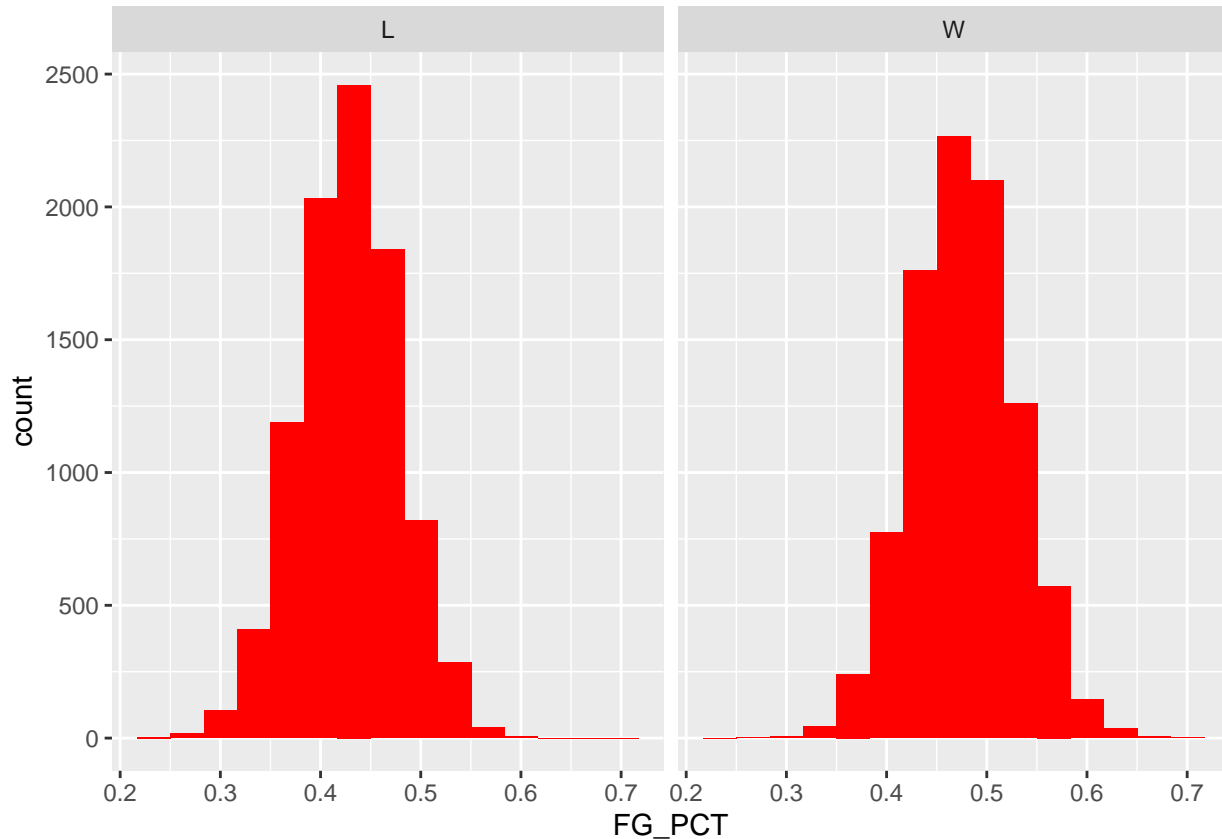


```
ggsave("FG_PCT_Distributions.png")
```

```
## Saving 6.5 x 4.5 in image
```

Histogram by the result of the game using the “facet_wrap” option

```
ggplot(NBA_Games, aes(x=FG_PCT)) +  
  geom_histogram(bins=15, fill = 'red') +  
  facet_wrap(~WL)
```



```
ggsave("FG_PCT_WL.png")
```

Saving 6.5 x 4.5 in image

Self Test

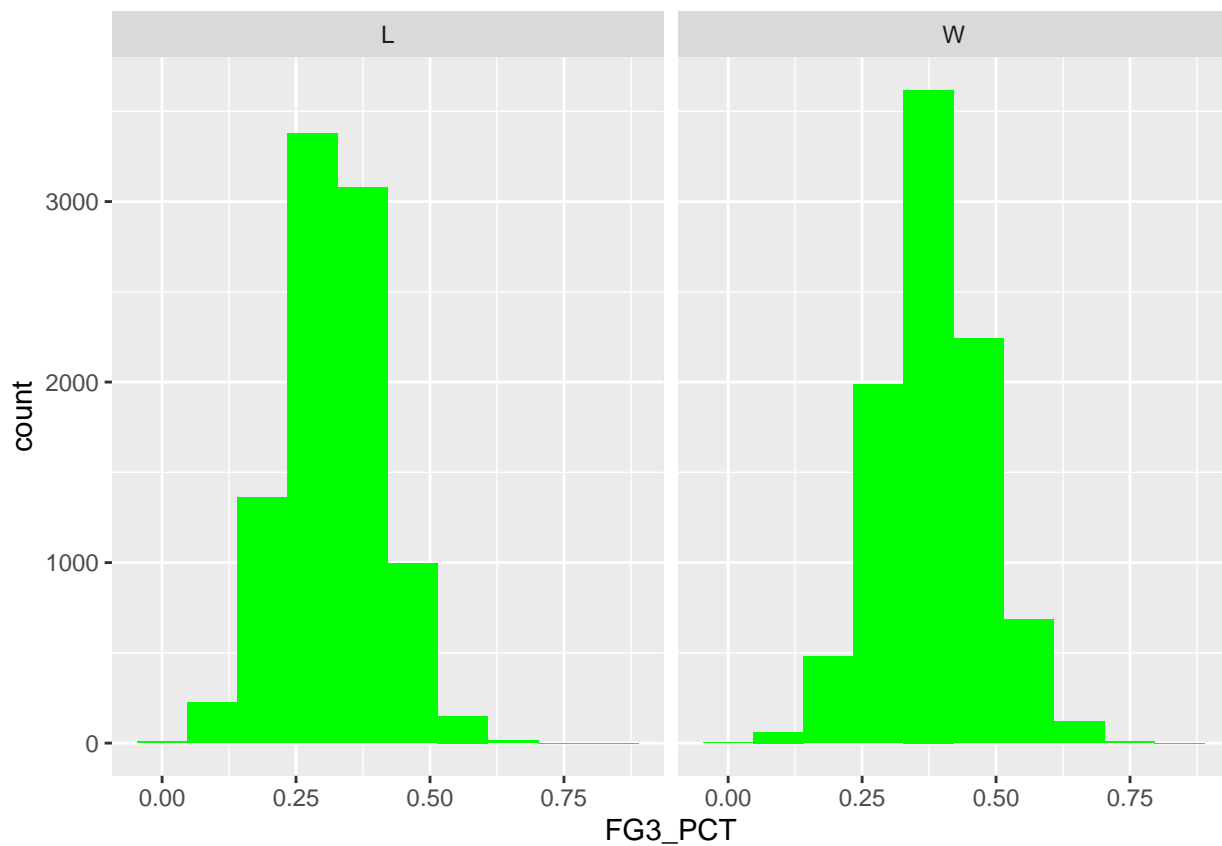
1. Calculate summary statistics for the three-point field goal percentage by the result of the game
 2. Graph a histogram of the three-point field goal percentage by the result of the game and provide interpretation
- Number of bins=10, the two subgraphs should have the same x and y ranges, color is green
 - Export the graph as “FG3_PCT_Distribution” in png format

```
NBA_Games %>% select(WL, FG3_PCT) %>%  
  group_by(WL) %>% summarise(count = n(),  
                              mean = mean(FG3_PCT),  
                              sd = sd(FG3_PCT),  
                              min = min(FG3_PCT),  
                              q25 = quantile(FG3_PCT, 0.25),  
                              median = median(FG3_PCT),  
                              q75 = quantile(FG3_PCT, 0.75),  
                              max = max(FG3_PCT),  
                              sd = sd(FG3_PCT)) %>% ungroup()
```

```
## 'summarise()' ungrouping output (override with '.groups' argument)
```

```
## # A tibble: 2 x 9
##   WL    count  mean    sd  min  q25 median  q75  max
##   <chr> <int> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>
## 1 L      9208 0.319 0.0915    0 0.259  0.318 0.379 0.714
## 2 W      9206 0.382 0.0969    0 0.318  0.381 0.444 0.842
```

```
ggplot(NBA_Games, aes(x=FG3_PCT)) +
  geom_histogram(bins=10, fill = 'green') +
  facet_wrap(~WL)
```



```
ggsave("FG3_PCT_Distribution.png")
```

```
## Saving 6.5 x 4.5 in image
```

Create time series graphs

Let's first change the data type of "GAME_DATE" from object to datetime. Since the GAME_DATE variable is in Year/Month/Day format, we can use the ymd() function from the lubridate package.

```
NBA_Games$GAME_DATE = ymd(NBA_Games$GAME_DATE)
head(NBA_Games$GAME_DATE)
```

```
## [1] "2019-07-12" "2019-07-11" "2019-07-09" "2019-07-07" "2019-07-06"
## [6] "2019-04-10"
```

Subsetting a dataset

The dataset we are working with contains games of different NBA teams. Let's focus on one team to produce a time series graph. Extract Pistons' game data in the 2017-2018 season.

Note that for date variable, we can use the >, =, < operators. When we specify the condition of the date, we need to use '' and make sure that it is a datetime variable.

```
Pistons_Games = NBA_Games %>% filter(NICKNAME == 'Pistons' & SEASON_ID == 22017 &  
                                     GAME_DATE >= ymd('2017-10-17'))  
head(Pistons_Games)
```

	CITY	TEAM_NAME	TEAM_ID	NICKNAME	STATE	YEAR_FOUNDED	SEASON_ID
## 1	Detroit	Detroit Pistons	1610612765	Pistons	Michigan	1948	22017
## 2	Detroit	Detroit Pistons	1610612765	Pistons	Michigan	1948	22017
## 3	Detroit	Detroit Pistons	1610612765	Pistons	Michigan	1948	22017
## 4	Detroit	Detroit Pistons	1610612765	Pistons	Michigan	1948	22017
## 5	Detroit	Detroit Pistons	1610612765	Pistons	Michigan	1948	22017
## 6	Detroit	Detroit Pistons	1610612765	Pistons	Michigan	1948	22017

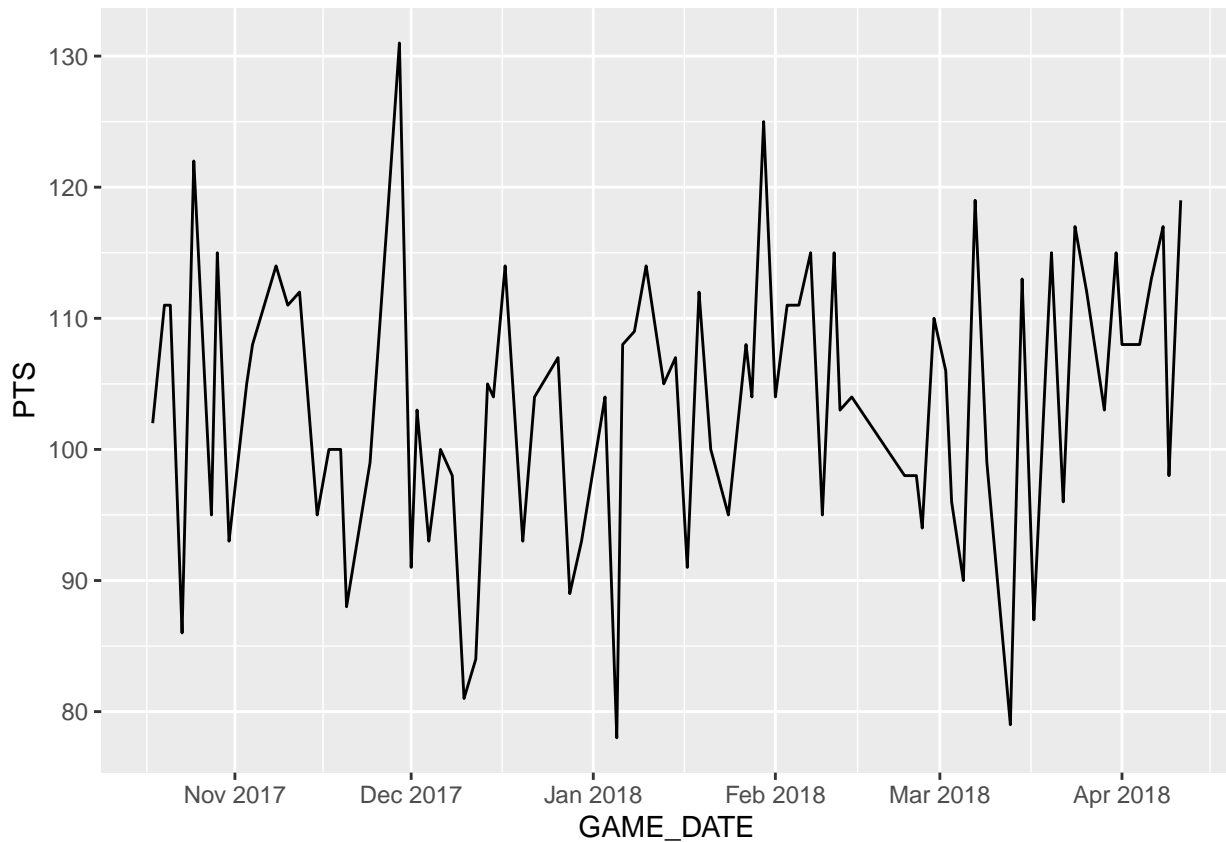
	TEAM_ABBREVIATION	GAME_ID	GAME_DATE	MATCHUP	WL	MIN	PTS	FGM	FGA	FG_PCT
## 1	DET	21701224	2018-04-11	DET @ CHI	W	240	119	47	89	0.528
## 2	DET	21701204	2018-04-09	DET vs. TOR	L	239	98	35	78	0.449
## 3	DET	21701199	2018-04-08	DET @ MEM	L	240	117	38	93	0.409
## 4	DET	21701181	2018-04-06	DET vs. DAL	W	265	113	46	92	0.500
## 5	DET	21701169	2018-04-04	DET vs. PHI	L	240	108	39	88	0.443
## 6	DET	21701148	2018-04-01	DET @ BKN	W	240	108	38	84	0.452

	FG3M	FG3A	FG3_PCT	FTM	FTA	FT_PCT	OREB	DREB	REB	AST	STL	BLK	TOV	PF	PLUS_MINUS
## 1	15	35	0.429	10	10	1.000	7	40	47	27	12	4	11	21	32
## 2	9	30	0.300	19	25	0.760	4	29	33	22	7	2	3	11	-10
## 3	23	47	0.489	18	23	0.783	14	24	38	30	10	0	12	18	-13
## 4	12	30	0.400	9	17	0.529	6	43	49	24	6	4	11	19	7
## 5	16	36	0.444	14	23	0.609	9	33	42	30	4	5	17	19	-7
## 6	7	19	0.368	25	32	0.781	10	43	53	17	9	3	9	16	12

	WIN
## 1	1
## 2	0
## 3	0
## 4	1
## 5	0
## 6	1

Now we can plot the points earned by the Pistons by time.

```
ggplot(data = Pistons_Games, aes(x=GAME_DATE, y=PTS)) + geom_line() +  
  scale_x_date(date_breaks = "1 month", date_labels = "%b %Y")
```



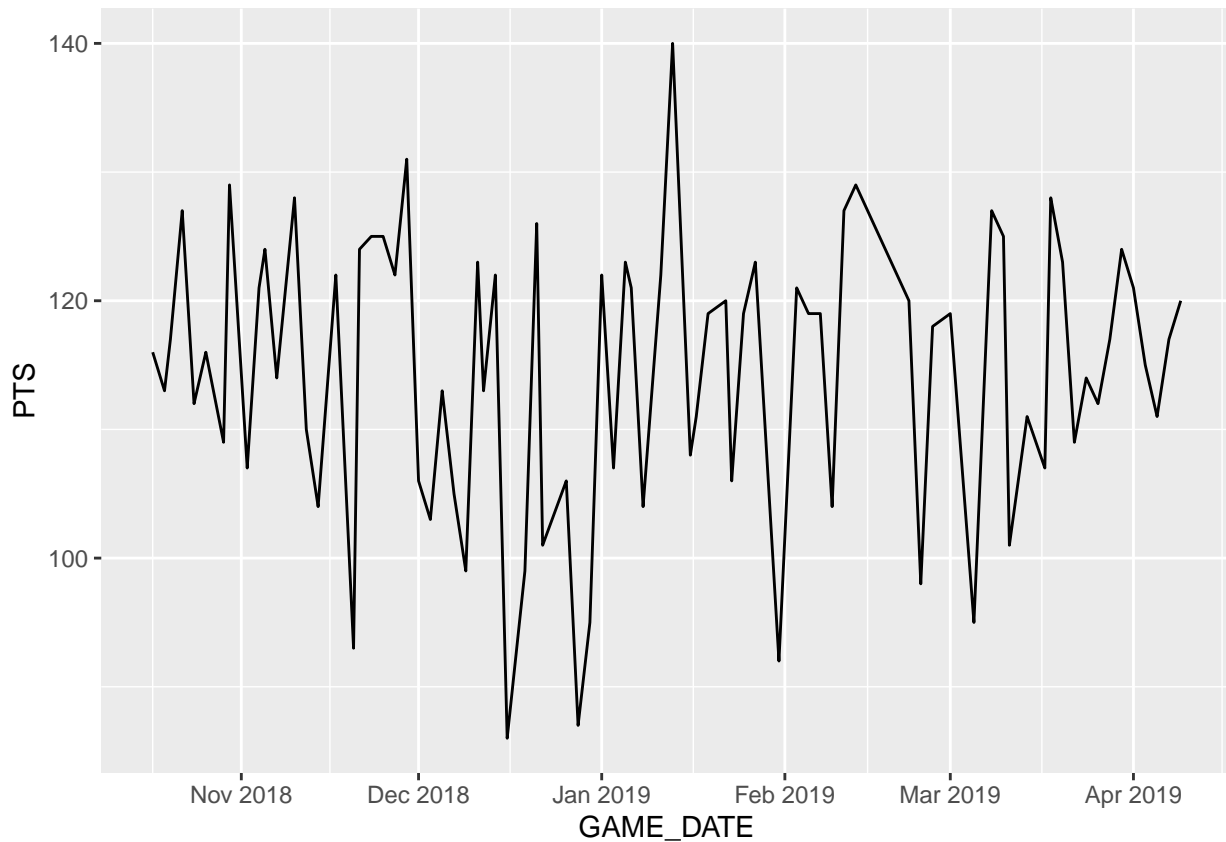
```
ggsave('PISTONS_PTS_TIME.png')
```

```
## Saving 6.5 x 4.5 in image
```


Self Test

1. Graph Toronto Raptors' points in each game throughout the 2018-2019 season. (SEASON ID is 22018, and the regular season started on October 16, 2018.)
2. Export the graph as "RAPTORS_PTS_TIME" in png format

```
Raptors_Games = NBA_Games %>% filter(NICKNAME == 'Raptors' & SEASON_ID == 22018 &  
                                     GAME_DATE >= ymd('2018-10-16'))  
ggplot(data = Raptors_Games, aes(x=GAME_DATE, y=PTS)) + geom_line() +  
  scale_x_date(date_breaks = "1 month", date_labels = "%b %Y")
```



```
ggsave('RAPTORS_PTS_TIME.png')
```

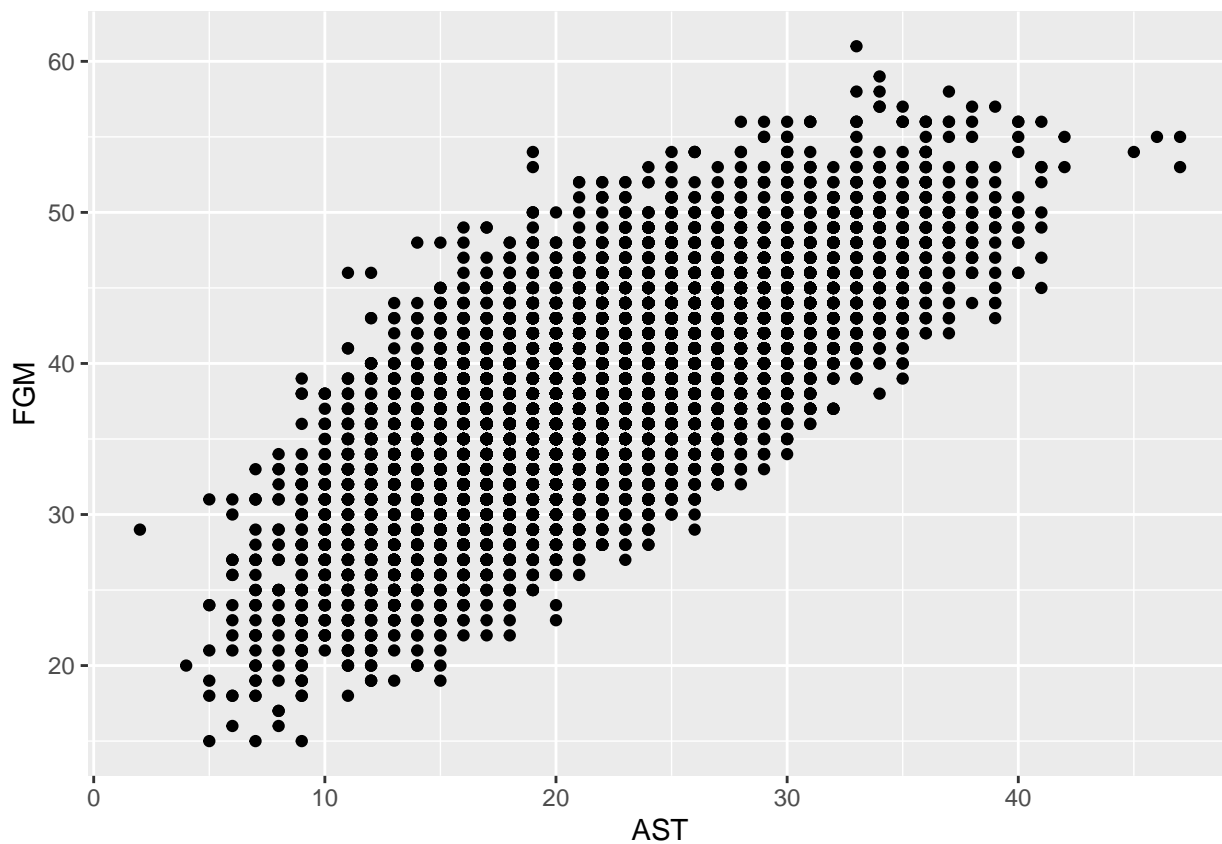
```
## Saving 6.5 x 4.5 in image
```

Correlation Analysis

We can first detect the relationship between two variables in a scatterplot.

Let's use the number of assists and the number of field goals made as an example. We can create a scatter plot using the “geom_point()” function with the number of assists in the horizontal axis and the number of field goals made in the vertical axis.

```
ggplot(NBA_Games, aes(x=AST, y=FGM)) + geom_point()
```

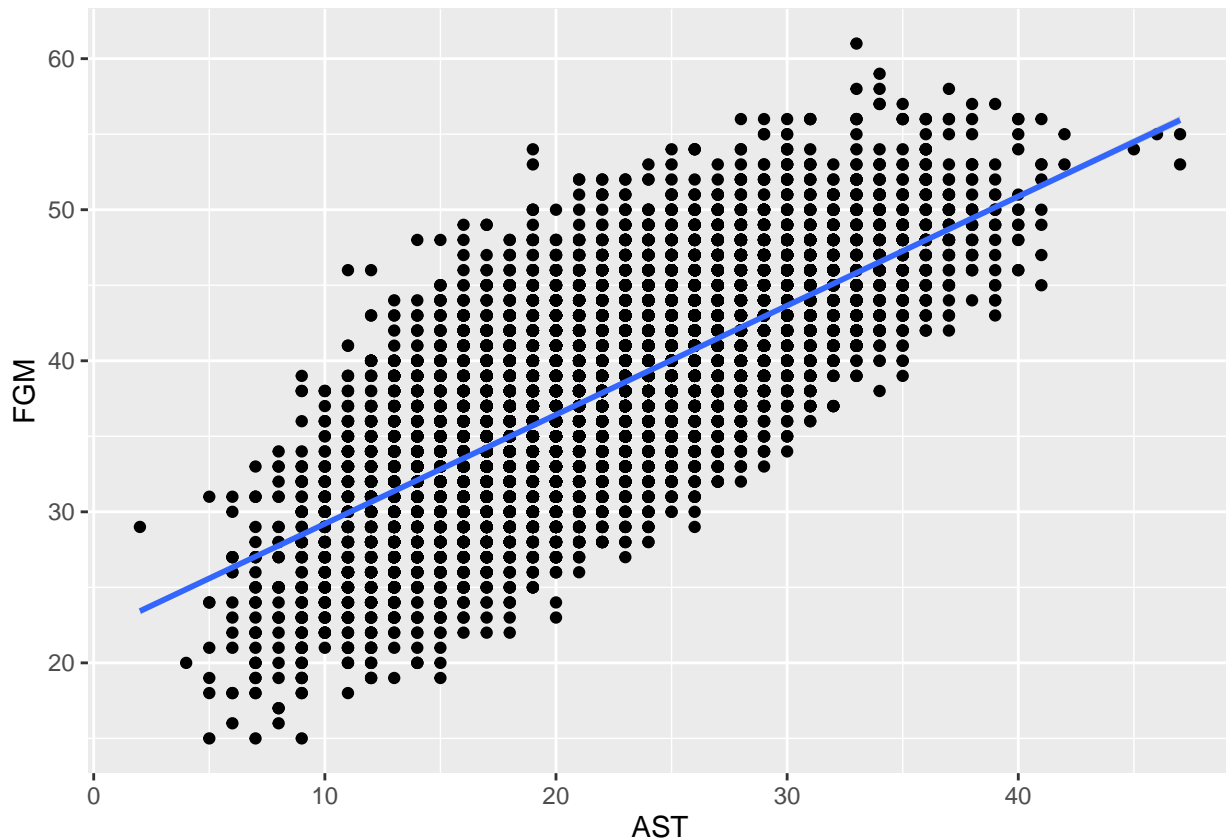


We can use the functions in the “ggplot2” library to graph the relationships between two variables

We will again use the function “geom_point()” to graph the scatter plot of the two variables, along with the geom_smooth(method=lm) function to add a regression line. theme() can be used to adjust the size of the plot title. We will learn about regression analysis more systematically in week 4

```
ggplot(NBA_Games, aes(x=AST, y=FGM)) + geom_point() +  
  geom_smooth(method=lm)
```

```
## 'geom_smooth()' using formula 'y ~ x'
```



As we can see from the graph, as the number of assists increase, the number of field goals made also increases. In this case, we say there is a positive relationship between the two variables, or a positive correlation.

Correlation Coefficient

```
cor(x = NBA_Games$AST, y = NBA_Games$FGM)
```

We can quantify the linear correlation by a correlation coefficient. A correlation coefficient measures the joint variability of two random variables. We can calculate correlation coefficient using the “cor” function.

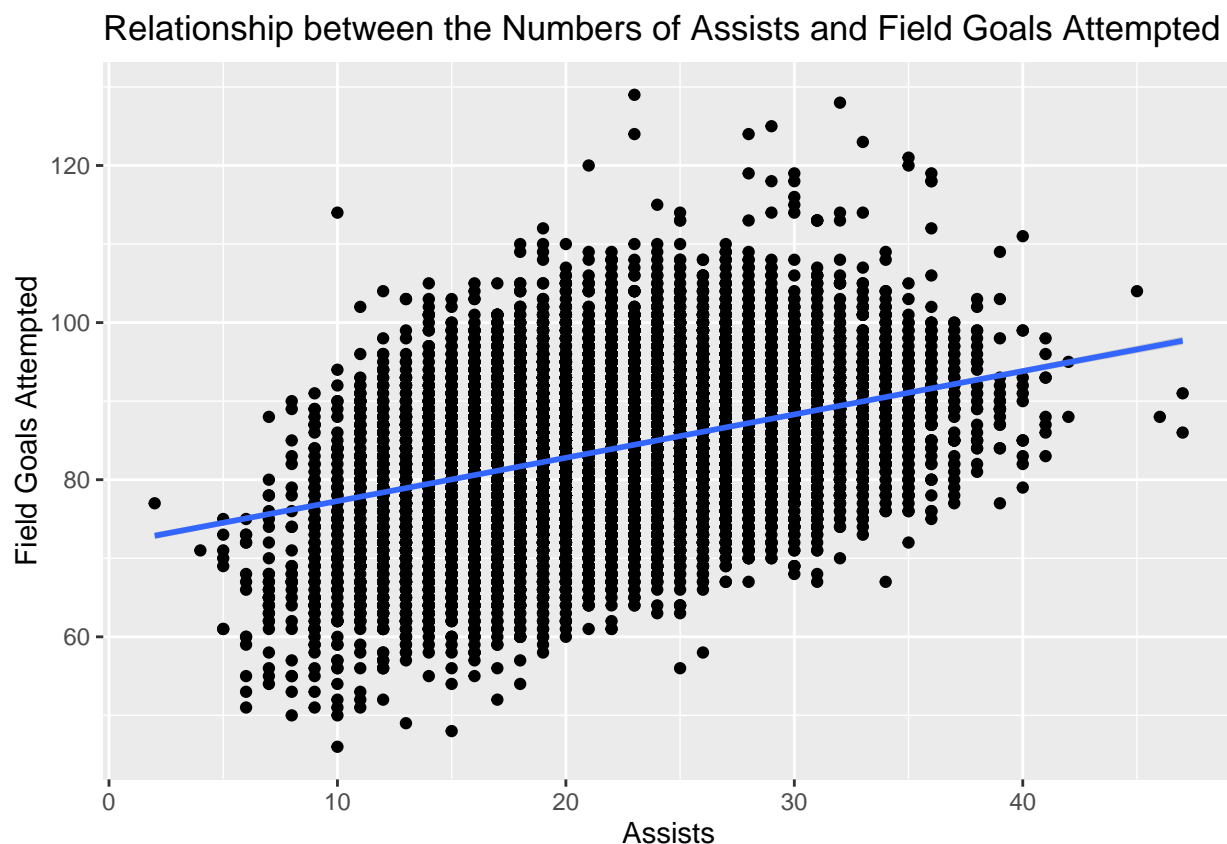
```
## [1] 0.6985104
```

The correlation coefficient between the number of assist and field goal made is 0.70 so there is a positive correlation between the two.

Let's investigate the relationship between the number of assists and the number of field goals attempted.

```
ggplot(NBA_Games, aes(x=AST, y=FGA)) + geom_point() +  
  geom_smooth(method=lm) +  
  labs(title = "Relationship between the Numbers of Assists and Field Goals Attempted",  
        x = "Assists", y = "Field Goals Attempted")
```

```
## 'geom_smooth()' using formula 'y ~ x'
```



```
cor(x = NBA_Games$AST, y = NBA_Games$FGA)
```

```
## [1] 0.3609691
```

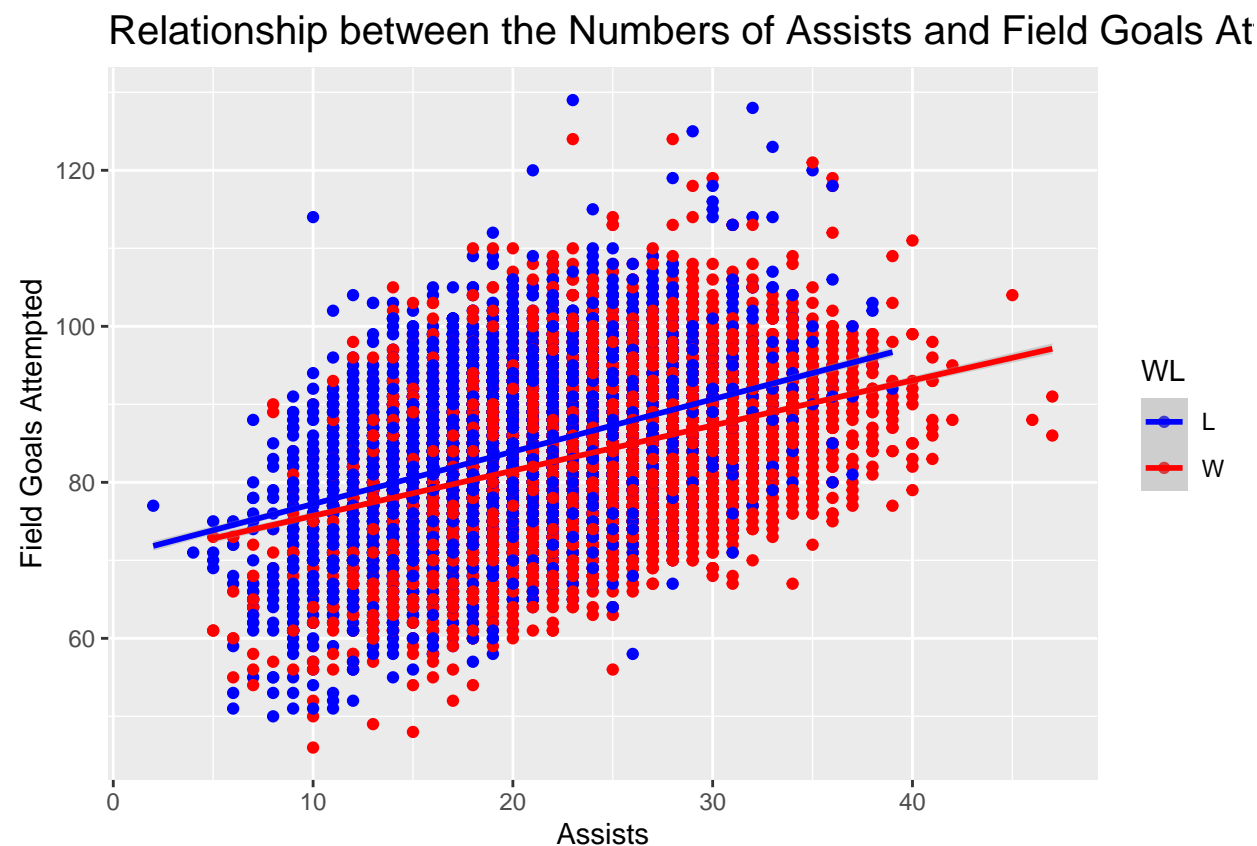
Both the graph and the correlation coefficient suggest that there is only a slight positive relationship between the two.

We can further graph the scatter plot by group using the “color” option.

Let’s separate by the results of the game (win or lose), and produce scatter plots between number of assists and field goals made. In this case, we can use `scale_color_manual()` to define the colors of the groups.

```
ggplot(NBA_Games, aes(x=AST, y=FGA, color = WL)) + geom_point() +
  scale_color_manual(values = c("W" = "red", "L" = "blue")) +
  geom_smooth(method=lm) +
  labs(title = "Relationship between the Numbers of Assists and Field Goals Attempted",
       x = "Assists", y = "Field Goals Attempted") +
  theme(plot.title = element_text(size = 15))
```

‘geom_smooth()’ using formula ‘y ~ x’



We can also find correlation coefficients for all the numerical variables. By default, the method for `cor()` is pearson.

```
cor(NBA_Games[sapply(NBA_Games, is.numeric)])
```

```
##          TEAM_ID  YEAR_FOUNDED  SEASON_ID  GAME_ID
## TEAM_ID      1.000000000  0.1588052105 -0.0295408140 -2.637992e-03
## YEAR_FOUNDED  0.158805211  1.0000000000 -0.0077786849  6.079689e-04
## SEASON_ID    -0.029540814 -0.0077786849  1.0000000000 -1.579237e-02
## GAME_ID      -0.002637992  0.0006079689 -0.0157923664  1.000000e+00
## MIN          0.007453932  0.0051991076  0.0369274814 -8.015957e-01
## PTS          -0.039884976 -0.0254269250 -0.0003129511 -3.884716e-01
## FGM          -0.022825843 -0.0270663820 -0.0021129693 -4.013296e-01
## FGA          -0.017755019 -0.0583060002 -0.0082074116 -4.310109e-01
## FG_PCT       -0.013090610  0.0161846813  0.0055797708 -1.591172e-01
```

## FG3M	-0.113089239	-0.0815503389	0.0308067797	-1.344295e-01	
## FG3A	-0.141616974	-0.1054893820	0.0352985750	-9.362936e-02	
## FG3_PCT	-0.016015665	-0.0052349411	0.0087968862	-1.068484e-01	
## FTM	0.022276207	0.0434410449	-0.0156946381	-4.260489e-02	
## FTA	0.027861190	0.0233288888	-0.0299682222	-9.514760e-03	
## FT_PCT	-0.014278454	0.0486494945	0.0268498725	-8.395157e-02	
## OREB	0.036325923	-0.0349350307	-0.0084665475	-2.276964e-02	
## DREB	-0.003939985	-0.0325228140	-0.0323333859	-2.521288e-01	
## REB	0.017363256	-0.0468894004	-0.0316934568	-2.225653e-01	
## AST	-0.100172234	-0.0733766974	-0.0367404525	-3.612030e-01	
## STL	-0.010541559	-0.0268677600	-0.0769045479	1.768021e-02	
## BLK	0.001361925	0.0065166807	-0.0013587377	-3.133288e-02	
## TOV	-0.027440097	-0.0910463681	-0.1525784539	9.067403e-02	
## PF	0.010287613	-0.0443062127	-0.0364253553	1.127954e-01	
## PLUS_MINUS	0.001770226	0.0207064558	-0.0076116196	-5.691711e-05	
## WIN	-0.004291493	0.0186777597	-0.0020511309	1.039780e-03	
##	MIN	PTS	FGM	FGA	FG_PCT
## TEAM_ID	7.453932e-03	-0.0398849762	-0.022825843	-0.017755019	-0.013090610
## YEAR_FOUNDED	5.199108e-03	-0.0254269250	-0.027066382	-0.058306000	0.016184681
## SEASON_ID	3.692748e-02	-0.0003129511	-0.002112969	-0.008207412	0.005579771
## GAME_ID	-8.015957e-01	-0.3884716361	-0.401329625	-0.431010910	-0.159117180
## MIN	1.000000e+00	0.4280092213	0.421932627	0.521587224	0.108377190
## PTS	4.280092e-01	1.0000000000	0.868216201	0.452361697	0.687991686
## FGM	4.219326e-01	0.8682162006	1.0000000000	0.569484505	0.752175726
## FGA	5.215872e-01	0.4523616971	0.569484505	1.0000000000	-0.106607870
## FG_PCT	1.083772e-01	0.6879916863	0.752175726	-0.106607870	1.0000000000
## FG3M	1.483303e-01	0.5526683490	0.388573632	0.210874799	0.299034324
## FG3A	1.356860e-01	0.3332616569	0.192631937	0.353799073	-0.052006144
## FG3_PCT	8.129105e-02	0.4608578469	0.369409879	-0.060976905	0.499490725
## FTM	8.469851e-02	0.2912516010	-0.151859801	-0.175009124	-0.039546404
## FTA	6.327768e-02	0.2317531723	-0.175986677	-0.192178000	-0.055475483
## FT_PCT	5.982881e-02	0.1843393735	0.035788564	0.010796011	0.036056912
## OREB	8.043540e-02	0.0181821919	0.027142830	0.456740058	-0.328142016
## DREB	3.007131e-01	0.2514705681	0.229918989	0.270132526	0.065507119
## REB	2.957235e-01	0.2194115786	0.206583983	0.484100673	-0.131973746
## AST	3.316692e-01	0.6479763285	0.698510369	0.360969053	0.554726622
## STL	6.525458e-03	0.0905520809	0.077970470	0.094883051	0.016110074
## BLK	6.103890e-02	0.0798412818	0.079702662	0.051503767	0.054380649
## TOV	-4.068858e-02	-0.1374207831	-0.176216496	-0.294181525	0.021875175
## PF	2.446366e-04	0.0813209679	-0.019851356	-0.003663061	-0.023063367
## PLUS_MINUS	9.593479e-05	0.5098332969	0.452970742	0.005459368	0.540105069
## WIN	-1.507787e-03	0.4090209735	0.341178143	-0.039797933	0.443240067
##	FG3M	FG3A	FG3_PCT	FTM	FTA
## TEAM_ID	-0.1130892395	-0.14161697	-0.016015665	0.02227621	0.02786119
## YEAR_FOUNDED	-0.0815503389	-0.10548938	-0.005234941	0.04344104	0.02332889
## SEASON_ID	0.0308067797	0.03529857	0.008796886	-0.01569464	-0.02996822
## GAME_ID	-0.1344294727	-0.09362936	-0.106848382	-0.04260489	-0.00951476
## MIN	0.1483303390	0.13568601	0.081291052	0.08469851	0.06327768
## PTS	0.5526683490	0.33326166	0.460857847	0.29125160	0.23175317
## FGM	0.3885736322	0.19263194	0.369409879	-0.15185980	-0.17598668
## FGA	0.2108747991	0.35379907	-0.060976905	-0.17500912	-0.19217800
## FG_PCT	0.2990343244	-0.05200614	0.499490725	-0.03954640	-0.05547548
## FG3M	1.0000000000	0.75904420	0.666182242	-0.09530354	-0.11615225
## FG3A	0.7590441994	1.00000000	0.062440564	-0.07540220	-0.08728871

## FG3_PCT	0.6661822417	0.06244056	1.000000000	-0.06130941	-0.08059611
## FTM	-0.0953035366	-0.07540220	-0.061309408	1.00000000	0.92373805
## FTA	-0.1161522540	-0.08728871	-0.080596111	0.92373805	1.00000000
## FT_PCT	0.0348080584	0.01774149	0.033901753	0.32752275	-0.03529480
## OREB	-0.1066689155	0.02503098	-0.188549381	0.05580948	0.09612107
## DREB	0.1404600005	0.16057135	0.037596482	0.05063983	0.04665325
## REB	0.0561777113	0.14772614	-0.075868041	0.07381262	0.09340164
## AST	0.4563270005	0.27329280	0.382781408	-0.12610078	-0.14969899
## STL	0.0003664217	0.03156353	-0.030837315	0.05813545	0.07428818
## BLK	0.0194835778	0.01512009	0.011487529	0.01897123	0.02208668
## TOV	-0.0391799076	-0.05059493	-0.005661024	0.04388451	0.06512564
## PF	0.0086207112	0.03050515	-0.020345759	0.21533864	0.24303954
## PLUS_MINUS	0.3169970338	0.07260749	0.387306075	0.10750007	0.06680181
## WIN	0.2301023578	0.01741796	0.320473977	0.14273231	0.11319623
##	FT_PCT	OREB	DREB	REB	AST
## TEAM_ID	-0.014278454	0.036325923	-0.003939985	0.01736326	-0.10017223
## YEAR_FOUNDED	0.048649495	-0.034935031	-0.032522814	-0.04688940	-0.07337670
## SEASON_ID	0.026849872	-0.008466548	-0.032333386	-0.03169346	-0.03674045
## GAME_ID	-0.083951569	-0.022769641	-0.252128802	-0.22256528	-0.36120296
## MIN	0.059828812	0.080435396	0.300713118	0.29572354	0.33166915
## PTS	0.184339374	0.018182192	0.251470568	0.21941158	0.64797633
## FGM	0.035788564	0.027142830	0.229918989	0.20658398	0.69851037
## FGA	0.010796011	0.456740058	0.270132526	0.48410067	0.36096905
## FG_PCT	0.036056912	-0.328142016	0.065507119	-0.13197375	0.55472662
## FG3M	0.034808058	-0.106668915	0.140460000	0.05617771	0.45632700
## FG3A	0.017741488	0.025030983	0.160571347	0.14772614	0.27329280
## FG3_PCT	0.033901753	-0.188549381	0.037596482	-0.07586804	0.38278141
## FTM	0.327522754	0.055809481	0.050639834	0.07381262	-0.12610078
## FTA	-0.035294797	0.096121069	0.046653246	0.09340164	-0.14969899
## FT_PCT	1.000000000	-0.089595966	0.019985191	-0.03428887	0.03807435
## OREB	-0.089595966	1.000000000	-0.014916309	0.55576236	-0.08280316
## DREB	0.019985191	-0.014916309	1.000000000	0.82295879	0.21572531
## REB	-0.034288866	0.555762358	0.822958793	1.00000000	0.13231550
## AST	0.038074347	-0.082803161	0.215725314	0.13231550	1.00000000
## STL	-0.023151264	0.024586537	-0.158647679	-0.11793584	0.07731081
## BLK	0.002170496	0.001452039	0.216567729	0.18088671	0.09546942
## TOV	-0.042257932	0.027153920	0.099490010	0.09814724	-0.07218473
## PF	-0.030977470	0.050855811	-0.047438484	-0.01054750	-0.05675745
## PLUS_MINUS	0.120731857	-0.014894161	0.398735693	0.32305997	0.37759330
## WIN	0.096915274	-0.033593907	0.327944215	0.25357702	0.28691969
##	STL	BLK	TOV	PF	
## TEAM_ID	-0.0105415591	0.001361925	-0.027440097	0.0102876129	
## YEAR_FOUNDED	-0.0268677600	0.006516681	-0.091046368	-0.0443062127	
## SEASON_ID	-0.0769045479	-0.001358738	-0.152578454	-0.0364253553	
## GAME_ID	0.0176802083	-0.031332876	0.090674026	0.1127954272	
## MIN	0.0065254576	0.061038901	-0.040688579	0.0002446366	
## PTS	0.0905520809	0.079841282	-0.137420783	0.0813209679	
## FGM	0.0779704701	0.079702662	-0.176216496	-0.0198513556	
## FGA	0.0948830506	0.051503767	-0.294181525	-0.0036630612	
## FG_PCT	0.0161100741	0.054380649	0.021875175	-0.0230633670	
## FG3M	0.0003664217	0.019483578	-0.039179908	0.0086207112	
## FG3A	0.0315635285	0.015120090	-0.050594931	0.0305051546	
## FG3_PCT	-0.0308373153	0.011487529	-0.005661024	-0.0203457594	
## FTM	0.0581354495	0.018971226	0.043884513	0.2153386411	

## FTA	0.0742881812	0.022086683	0.065125642	0.2430395446
## FT_PCT	-0.0231512641	0.002170496	-0.042257932	-0.0309774702
## OREB	0.0245865369	0.001452039	0.027153920	0.0508558114
## DREB	-0.1586476791	0.216567729	0.099490010	-0.0474384842
## REB	-0.1179358359	0.180886707	0.098147235	-0.0105474993
## AST	0.0773108068	0.095469424	-0.072184730	-0.0567574485
## STL	1.0000000000	0.005052785	0.129837398	0.0497978498
## BLK	0.0050527846	1.000000000	0.042207789	0.0088073089
## TOV	0.1298373977	0.042207789	1.000000000	0.2195526518
## PF	0.0497978498	0.008807309	0.219552652	1.0000000000
## PLUS_MINUS	0.1662938990	0.183126363	-0.123858647	-0.0516344493
## WIN	0.1362045164	0.165842235	-0.107469182	-0.1043934371
##	PLUS_MINUS	WIN		
## TEAM_ID	1.770226e-03	-0.004291493		
## YEAR_FOUNDED	2.070646e-02	0.018677760		
## SEASON_ID	-7.611620e-03	-0.002051131		
## GAME_ID	-5.691711e-05	0.001039780		
## MIN	9.593479e-05	-0.001507787		
## PTS	5.098333e-01	0.409020973		
## FGM	4.529707e-01	0.341178143		
## FGA	5.459368e-03	-0.039797933		
## FG_PCT	5.401051e-01	0.443240067		
## FG3M	3.169970e-01	0.230102358		
## FG3A	7.260749e-02	0.017417964		
## FG3_PCT	3.873061e-01	0.320473977		
## FTM	1.075001e-01	0.142732309		
## FTA	6.680181e-02	0.113196225		
## FT_PCT	1.207319e-01	0.096915274		
## OREB	-1.489416e-02	-0.033593907		
## DREB	3.987357e-01	0.327944215		
## REB	3.230600e-01	0.253577016		
## AST	3.775933e-01	0.286919689		
## STL	1.662939e-01	0.136204516		
## BLK	1.831264e-01	0.165842235		
## TOV	-1.238586e-01	-0.107469182		
## PF	-5.163445e-02	-0.104393437		
## PLUS_MINUS	1.000000e+00	0.804201278		
## WIN	8.042013e-01	1.000000000		