STAT601: Apex Legends by Shannon Imbo

Welcome to Apex Legends!

In my spare time, I play videogames to relax and unwind from university work. One game I'm particularly fond of, is Apex Legends. Apex Legends is a first-person shooting game in which players are set in a battle royale style enviromnment much like the movie "The Hunger Games". In this game, 20 squads in groups of three each dive into their desired location in the map. Each squad must then scavenge weapons and items for survival and must defeat other squads to become the Apex legend. The game ends if all of the members your squad are defeated or if you manage survive and defeat the remaining squads. Your squad's rank is determined on how many squads were defeated before yours (e.g. a rank of 18 out of 20 means 2 squads were wiped out before yours).

Figure 1: endgame results

Crunch the Numbers!

In my dataset, the columns represent the data that is displayed after you die or win the match while each row represents a game. There is a total of 88 rows. I will also assign the columns into individual variables for ease of use.

```
APEX <- READ.TABLE("H:/APEX.TXT",HEADER=TRUE)
HEAD(APEX)
```

```
##   KILLS DAMAGE_DEALT SURVIVAL_TIME.MINS. RANK FULL_SQUAD
## 1    10         2223                21    1       TRUE
## 2     6         1195                17    2       TRUE
## 3     3         1232                11    6       TRUE
## 4     3          717                 9    8       TRUE
```

```
## 5    13        2365                 18    1       TRUE
## 6     0         200                  2   16       TRUE
```

```
NROW(APEX)
```

```
## [1] 88
```

```
DAMAGE<- APEX$DAMAGE_DEALT
KILLS<-APEX$KILLS
TIME<-APEX$SURVIVAL_TIME.MINS.
RANK<-APEX$RANK
FULL<-APEX$FULL_SQUAD
```

The first row indicates that I managed to kill 10 opponents, dealt 2,223 damage in total, I managed to stay alive for 21 minutes, achieve a rank of 1 out 20 squads, and I had a full squad with me (if full squad is false, then I would've played alone or our 3rd player is a stranger). The 6th row however shows that I killed no one and that my damage was only an amount of 200 with survival time being 2 minutes and placing 16 out of 20 despite having a full squad.

My expectation is that surviving longer increases the total amount of damage I get. I should achieve mean damage if the game has lasted longer than 10 minutes. Hence my null will be: survival time has no effect on the amount of damage I get.

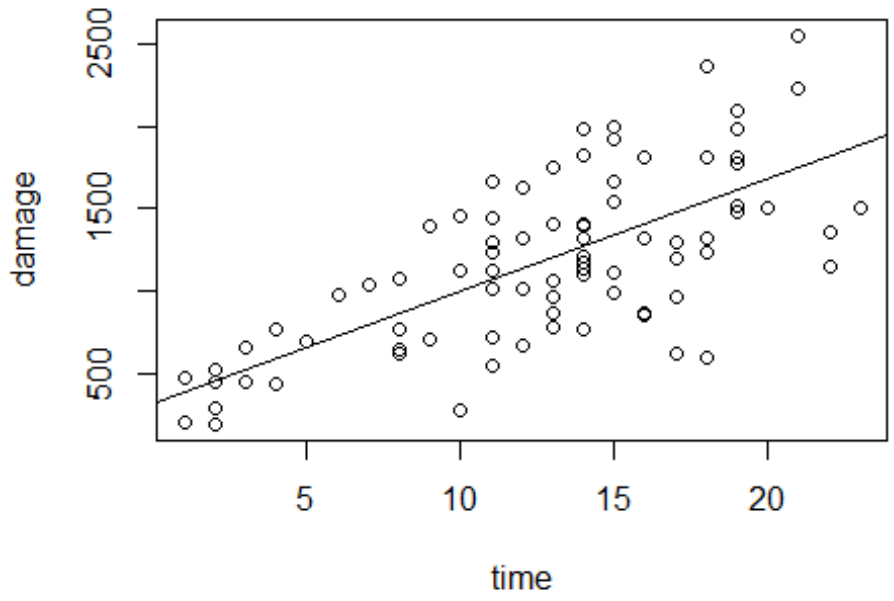
Let m be the mean of damage H0: m < 10

H1: m >= 10

Linear Regression for More Aaggression!

Let's run a linear regression model on the two variables. It is always wise to plot the data first to get a visual analysis of the dataset. We will plot damage as a function of survival time.

```
R PLOT(DAMAGE~TIME) ABLINE(LM(DAMAGE~TIME))
```



On the bright side, all the values are positive and we don't need to worry about logging the negative values. The relationship between damage and time is easily observable from the scatterplot (good thing we plotted it).

We can further prove this by using a summary of a linear model for the two variables.

```
R SUMMARY(LM(DAMAGE~TIME))
```

```
Call:
lm(formula = damage ~ time)

Residuals:
    Min      1Q  Median      3Q     Max
-946.09 -238.63  -69.91  227.22  815.91

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  326.640    109.730   2.977  0.00378 **
time          67.914      7.874   8.625 2.85e-13 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 394 on 86 degrees of freedom
Multiple R-squared:  0.4638,  Adjusted R-squared:  0.4576
F-statistic:  74.4 on 1 and 86 DF,  p-value: 2.849e-13
```

Interpretation: The coefficients read the y intercept to begin at 326. Time is set to 67.914. The time coefficient states that every time minutes increases then damage increases by 67. Let us set our significant value to be 5%. Our p-value is an extremely low value of 2.849e-13 and therefore we can reject the null hypothesis.

Pearson's Chi Squared test

More time, more damage!

I should get more damage the longer the game increases since I should be able to encounter more enemies, the longer I live.

Null Hypothesis: I should deal the same damage regardless of survival time.

```
DAMAGE_EXP<- REP(MEAN(DAMAGE),LENGTH(DAMAGE)) #EXPECTATION FOR DAMAGE
B<-SUM((DAMAGE-DAMAGE_EXP)^2/DAMAGE_EXP) #BADNESS OF FIT
```

Let's test the null hypothesis against a significant value of 5%.

```
PCHISQ(B,DF=LENGTH(DAMAGE)-1,LOWER.TAIL = FALSE)
```

```
## [1] 0
```

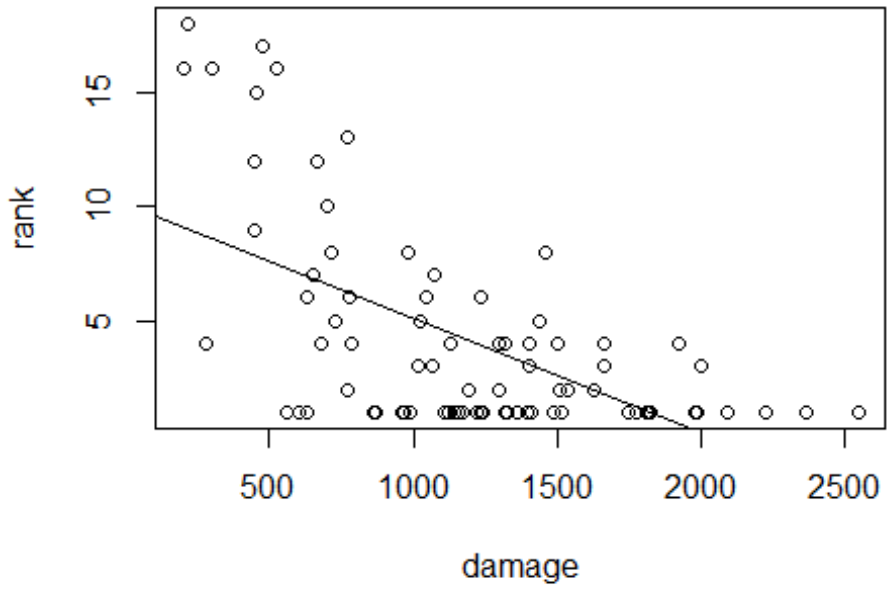
The actual degrees of freedom for my dataset will be 87 since the number of rows are 88. With the degrees of freedom being very large, the chi squared test retrieved a value of 0 which means that this is well below the significant value of 0.5 (5%).

With this in mind, we can safely continue to reject the null hypothesis and answers the question. I do get to fight more enemies the longer I stay alive and get a chance to bump up my damage by the end of the game.

Champions are Scary…

What if we match damage with rank? Have I dealt better damage with higher ranks? Will I achieve a higher rank if I perform well in doing damage to enemies? Let's plot it.

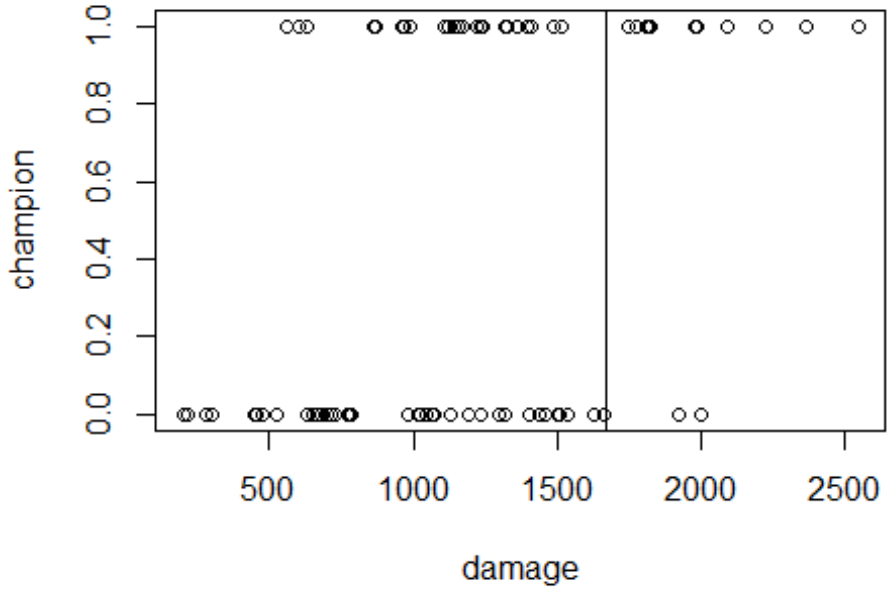
```
PLOT(RANK~DAMAGE)
ABLINE(LM(RANK~DAMAGE))
```



The graph clearly shows a negative trend that most of the higher damage games lie within ranks where I become a champion.

we can display this cleaer using logistic regression. We'll assign a new variable called "champion" in which it will store the games that I've become champion and compare them to the damage I've done.

```
CHAMPION <- RANK <=1
PLOT(CHAMPION~DAMAGE)
ABLINE(V=1670)
```



Here we can see a clear divide between games where I've won as a champion at the top and the ones I didn't win are shown below turning the model into binomial data. The points in the model show that they are moving to the right. Just a little over 1500 damage can we see a clear picture of division between damage done as a champion and dying. There are games when I still manage to deal a lot of damage despite dying, but it is clearly shown that I tend to deal a lot more damage if I win the game as well.

Using Logistic regression

```
SUMMARY(GLM(CHAMPION~DAMAGE,FAMILY="BINOMIAL"))
```

```
##
## Call:
## glm(formula = CHAMPION ~ DAMAGE, family = "BINOMIAL")
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -1.7579  -0.9804  -0.5649   1.1131   1.8061
##
## Coefficients:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept) -2.4650753  0.6737800  -3.659 0.000254 ***
## DAMAGE       0.0018851  0.0005209   3.619 0.000296 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
```

```
##
##     Null deviance: 121.27  on 87  degrees of freedom
## Residual deviance: 104.35  on 86  degrees of freedom
## AIC: 108.35
##
## Number of Fisher Scoring iterations: 3
```

The p-value is again much less compared to our significant value of 0.5 (5%) and hence we reject the null again.

Conclusion

Being a champion in Apex Legends would mean that you can expect your damage values to be higher compared to when you die earlier on the game. Survival time can also help increase your ability to deal more damage as you encounter more enemies to tussle with.Typically, the players who become champions can be expected to have higher survival times and also tons of damage. (Note: The game displays the champions of the previous game before the match starts so I advise to stay clear of these guys early on). These conclusions are only drawn from the end game results and have not taken into account other variables as quality of gear (weapons, armor…etc) and I didn't have enough time to compare games when I play with a full squad or with a stranger as playing with a fully made squad would mean better communication and overall teamplay.

*Here's a little clip of me playing the game with my friends.

https://www.youtube.com/watch?v=WH_qeWbKzx4

*Please excuse my nerdy voice and the quality of the video.