IEE 380 Project Spring 2021
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Objectives:

The objective of the project is to gain data collection, paired T-test calculations, and confidence interval calculations experience and to improve students technical writing skills.

Paired T-Test:

A paired T-test is a test for two variables of the same subject after some sort of change, a before and an after.

Data Description:

The data that I collected is from 30 different games on two different champions in a game called league of legends. In each game the creep score per minute, or cpm is collected which is a number indicating how many minions were slain per minute which is a good indicator of high gold which means i'm doing good in the game. Varus and Vayne, the champion I took data from, are my two main characters. The data was retrieved from the official league of legends match history tool and then I edited in excel to calculate creep score per minute for these champions and removed others.

https://matchhistory.na.leagueoflegends.com/en/#match-history/NA1/214880072

Data and summary statistics:

The data collected from the match history website can be seen below:

Game	Vayne (cpm)		Game	Varus (cpm)
Game 1	4.2		Game 1	4.15
Game 2	4.03		Game 2	6.33
Game 3	3.96		Game 3	3.51
Game 4	4.91		Game 4	4.44
Game 5	4.5		Game 5	5.96
Game 6	4.56		Game 6	4.66
Game 7	5.16		Game 7	7.66
Game 8	4.24		Game 8	6.23
Game 9	3.82		Game 9	5.1
Game 10	5.05		Game 10	3.43
Game 11	3.86		Game 11	6.75
Game 12	3.43		Game 12	6.52
Game 13	7.04		Game 13	8.14
Game 14	4.21		Game 14	5.89
Game 15	6.37		Game 15	4.21
Game 16	5.28		Game 16	4.51
Game 17	4.92		Game 17	6.71
Game 18	4.73		Game 18	8.02
Game 19	5.6		Game 19	7.4
Game 20	4.62		Game 20	7.21
Game 21	4.47		Game 21	6.03
Game 22	4.29		Game 22	5.6
Game 23	5.57		Game 23	5.36
Game 24	3.52		Game 24	5.81
Game 25	4.08		Game 25	6.86
Game 26	4.33		Game 26	6.72
Game 27	3.51		Game 27	6.21
Game 28	5.25		Game 28	5.72
Game 29	5.87		Game 29	7.97
Game 30	4.36		Game 30	6.51
Average	4.658			5.987333
Standard Deviation	0.845623			1.302072

Mean Difference: 1.33
Standard deviation: 1.44

Hypothesis Test:

The purpose of the experiment is to determine if I am better at Varus or Vayne since cpm is a good indicator that the game is going well and I am winning.

Null:
H_0: There is no difference in cpm between Varus and Vayne.

Alternative:
H_1: There is a difference in of cpm between Varus and Vayne

Test Statistics:

These formulas are using the mean difference to calculate a t value.

Vayne

N_1: 30
$df_1 = N - 1 = 30 - 1 = 29$
M_1: 4.66
SS_1: 20.74
$s^2_1 = SS_1/(N - 1) = 20.74/(30-1) = 0.72$

Varus

N_2: 30
$df_2 = N - 1 = 30 - 1 = 29$
M_2: 5.99
SS_2: 49.17
$s^2_2 = SS_2/(N - 1) = 49.17/(30-1) = 1.7$

<u>T-value Calculation</u>

$s^2_p = ((df_1/(df_1 + df_2)) * s^2_1) + ((df_2/(df_2 + df_2)) * s^2_2) = ((29/58) * 0.72) + ((29/58) * 1.7) = 1.21$

$s^2_{M1} = s^2_p/N_1 = 1.21/30 = 0.04$

$s^2_{M2} = s^2_p/N_2 = 1.21/30 = 0.04$

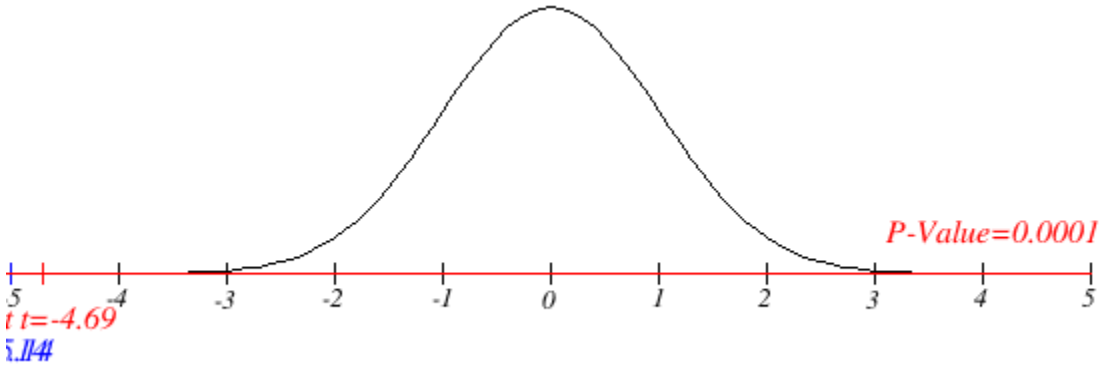
$t = (M_1 - M_2)/\sqrt{(s^2_{M1} + s^2_{M2})} = -1.33/\sqrt{0.08} = -4.69$

The *t*-value is -4.68968.

P Value:

The *p*-value is .000017.

There is significant evidence that there is a difference in my Vayne vs Varus since a p value of .000017 is less than α=0.05 for the 30 games I played of each.



Confidence Interval:

<u>Pooled Variance</u>
$s^2_p = ((df_1)(s^2_1) + (df_2)(s^2_2)) / (df_1 + df_2) = 69.9 / 58 = 1.21$

<u>Standard Error</u>
$s_{(M1 - M2)} = \sqrt{((s^2_p/n_1) + (s^2_p/n_2))} = \sqrt{((1.21/30) + (1.21/30))} = 0.28$

<u>Confidence Interval</u>
$\mu_1 - \mu_2 = (M_1 - M_2) \pm ts_{(M1 - M2)} = 1.3293 \pm (2 * 0.28) = 1.3293 \pm 0.56740479$

With 95% Confidence the interval is:

0.76192821 to 1.89673779.

Discussion:

I concluded that there was a difference in how well I was doing on those two champions since the p value was so low. I am really the only benefit of this test as it was on my gameplay, but this could be used to create a tool to show other players how they are doing on certain champions as this data was not easy to organize from existing tools. I really enjoyed this project and found huge motivation in apply what I've learned into something I'm passionate about.

References:

League of Legends Match History. (n.d.). Retrieved April 13, 2021, from https://matchhistory.na.leagueoflegends.com/en/#match-history/NA1/214880072