# MAT 243 Project Two Summary Report

Sarah Steinbaum

Sarah.steinbaum@snhu.edu

Southern New Hampshire University

## Introduction: Problem Statement

I am conducting an analysis using a large historical data set on two basketball teams from the NBA; the Chicago Bulls from the years 1996 to 1998 and the Atlanta Hawks from the years 2013 to 2015. The purpose of this analysis is to find statistically significant information through conducting hypothesis testing on claims made on the performance of the Atlanta Hawks. I will use statistically valid findings to provide evidence to validate these critical claims and to help the coach and management make key decisions to improve the team’s performance in future seasons. The statistical methods I will utilize in this analysis include hypothesis tests to find the population mean and proportion, and the difference between two population means through the Python programming language.

## Introduction: Your Team and the Assigned Team

For this analysis, I chose the Atlanta Hawks from the years 2013 to 2015. I was assigned the Chicago Bulls from the years 1996 to 1998. This information is represented in the table below.

Table 1. Information on the Teams

|  | **Name of Team** | **Years Picked** |
| --- | --- | --- |
| 1. Yours | Atlanta Hawks | 2013 - 2015 |
| 2. Assigned | Chicago Bulls | 1996 - 1998 |

## Hypothesis Test for the Population Mean (I)

Hypothesis testing provides information on claims or assumptions of a population mean and uses statistical testing to see if there is enough data to determine if that claim is true. The null hypothesis, H0, is a statistical hypothesis that states that there is no difference between two variables and is assumed to be true until there is enough evidence to suggest otherwise. In this scenario, the null hypothesis is that the relative skill of the Hawks between 2013 to 2015 is equal to 1340. The alternative hypothesis, Ha, is a claim that contradicts the null hypothesis, which in this would be that the relative skill of the Hawks between 2013 to 2015 was greater than 1340. The level of significance (**α**) is a value that is compared to the p-value in order to decide if the null hypothesis should be kept or rejected and is 0.05, or 5%, in this scenario.

Null Hypothesis (H0): = 1340

Alternative Hypothesis (Ha): > 1340

Table 2: Hypothesis Test for the Population Mean (I)

| **Statistic** | **Value** |
| --- | --- |
| Test Statistic | 44.46  *\*Round off to 2 decimal places.* |
| P-value | 0.0000  *\*Round off to 4 decimal places.* |

Since the p-value is 0 and is less than the level of significance, which is 0.05, the test is considered statistically significant. This means that management is correct in their hypothesis and the average relative skill level of the Hawks is in fact greater than 1340. There is sufficient evidence to reject the null hypothesis. In practical terms, this means that the Hawks do not have a critically low skill level in the league.

## Hypothesis Test for the Population Mean (II)

In this scenario, the null hypothesis is that the average number of points the Hawks scored between 2013 to 2015 is 106 points. The alternative hypothesis is what the coach hypothesized, that the average number of points the Hawks scored in the corresponding years is less than 106. The level of significance in this scenario is 0.01 or 1%.

Null Hypothesis: (H0): = 106

Alternative Hypothesis: (Ha): < 106

This hypothesis test is considered one-tailed and the standard deviation for points scored is unknown. Because of this, we will use a t-test in order to calculate the test statistic. The p-value is 0.0. We divide the p-value by 2 which equals 0.0. (0/2 = 0). Since the p-value is less than the level of significance, the test is statistically significant. This means that there is enough evidence to reject the null hypothesis. The Hawks’ average number of points scored between 2013 to 2015 is less than 106 which means that the coach was correct in his hypothesis and the team needs more practice to improve their score in future games.

Table 3: Hypothesis Test for the Population Mean (II)

| **Statistic** | **Value** |
| --- | --- |
| Test Statistic | -7.44  *\*Round off to 2 decimal places.* |
| P-value | 0.0000  *\*Round off to 4 decimal places.* |

## Hypothesis Test for the Population Proportion

A population proportion is a certain value or percentage of a population that has a particular characteristic. Hypothesis testing used to test claims about a population proportion normally tests to see if the population proportion is different or similar to the hypothesized population. In this scenario, the null hypothesis is that the proportion of games the Hawks win when scoring 102 or more points is 0.90. The alternative hypothesis is that the proportion of games the Hawks wins when scoring 102 or more points is not equal to 0.90.

Null Hypothesis (H0): p = 0.90

Alternative Hypothesis (Ha): p ≠ 0.90

In order to solve this hypothesis test, a z-test is calculated through Python involving multiplying the number of times the Hawks win when they score more than 102 points to the inverse of the total number of games played when the Hawks scored more than 102 points. Since the p-value is 0.0, and less than the level of significance, this test is also statistically significant as there is enough evidence to reject the null hypothesis. This means that the proportion of games the Hawks win when scoring 102 or more points is not equal to .90 and is instead, less than 0.90. The Hawks need more practice in order to improve their performance.

Table 4: Hypothesis Test for the Population Proportion

| **Statistic** | **Value** |
| --- | --- |
| Test Statistic | -4.35  *\*Round off to 2 decimal places.* |
| P-value | 0.0000  *\*Round off to 4 decimal places.* |

## Hypothesis Test for the Difference Between Two Population Means

Hypothesis testing is used to test claims about the difference between two population means. Hypothesis testing involves testing two separate data sets and comparing them to see if they are equal or different. In this scenario, the null hypothesis is that the skill level of the Hawks from 2013 to 2015 is the same as the skill level of the Bulls from 1996 to 1998. The alternative hypothesis is that the skill level of the two teams and their respective years is not equal.

Null Hypothesis (H0):

Alternative Hypothesis (Ha): ≠

The p-value is 0 which is less than the level of significance of 0.01, or 1%, which indicates that the test is statistically significant and that there is sufficient evidence to reject the null hypothesis. The Hawks’ skill level between 2013 to 2015 was different than the Bull’s skill level from the years 1996 to 1998.

Table 5: Hypothesis Test for the Difference Between Two Population Means

| **Statistic** | **Value** |
| --- | --- |
| Test Statistic | 36.16  *\*Round off to 2 decimal places.* |
| P-value | 0.0000  *\*Round off to 4 decimal places.* |

## Conclusion

In conclusion, the null hypothesis was rejected in each test because the p-value was 0.0 for each scenario which caused it to be less than the level of significance. It was found that the Atlanta Hawks from the years 2013 to 2015 had a relative skill level higher than 1340, the average number of points scored was below 106, the proportion of games the Hawks win when scoring 102 or more points is less than 90%, and their skill level was different and/or worse compared to the Chicago Bulls from the years 1996 to 1998. Overall, the Hawks dis not have a critically low score using this data set, but there is an evident need for improvement in order for the coach and management to see an increase in team performance.