# MAT 243 Project Two Summary Report

Nicholas Kreuziger

nicholas.kreuziger@snhu.edu

Southern New Hampshire University

# Introduction: Problem Statement

In this analysis we are going to answer the Coach and Management team of the San Antonio Spur’s. They have requested that we test a few hypotheses about the team they are managing to gain better insights about their team. The problem is not being fully aware of the statistical patterns being provided by the historical dataset. This analysis will use data from the 1996-1998 Chicago Bulls and the 2013-2015 Spurs. There are multiple Hypothesis being tested.

We will be using Z-tests and T-tests. Z-tests are typically used to compare population averages to a sample and will tell you how far a data point is from the average of a data set. Think “*Are the averages of this dataset similar to this sample?”*. A T-test will also test a hypothesis with an added functionality of determining if there is a statistically significant comparison between 2 independent sample groups. Think “*Are the comparisons between two independent groups unlikely to have occurred by chance?”*.

The tail of a test is determined by what conclusion is being tested. A two-tailed test is testing if a value is or is not equal. A left-tailed test is testing if a value is less than, while a right-tailed test is testing if a value is greater than.

The statements being tested, and the types of tests are as follows. “The average relative skill level of the Spurs in 2013-2015 is greater than 1342”. This is a 1 Sample t-test. Right tailed since we’re testing if a value is greater than. “The Spurs at an average of less than 110 points between 2013-2015”. This is a 1 Sample t-test. Left tailed since we’re testing if a value is less than. “The Spurs score 80 or more points 50% of the time when a game is won”. 2 Sample z-test. Two tailed since we’re testing for an equality. “The Spurs from 2013-2015 have the same Relative Skill Level as the Chicago Bulls in 1996-1998”. 2 Sample t-test. Two tailed since we’re testing for an equality.

# Introduction: Your Team and the Assigned Team

Table 1. Information on the Teams

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

# Hypothesis Test for the Population Mean (I)

A one sample Hypothesis testing ​procedure is used to test claims about a population mean based upon sample evidence and probability. ​The variable of interest is continuous, from sample data. The hypothesized mean is provided as part of the problem definition. A Null Hypothesis and ​an Alternative Hypothesis are presented, the P-Value is tested against ​compared to a level of significance, typically 0.05. ​The null hypothesis is about equality, or the claim to be evaluate. The statements are written and evaluated against the hypothesized mean. The test statistic and p-value are calculated from the sample data using technology or software. If the distribution of the data is normal, or if the sample size is large and the standard deviation is known then a z-test can be performed. However, when the sample size is small, and the standard deviation is unknown, then a t-test will be used. If the P-Value is greater than the Significance level (α)​, we fail to reject the Null Hypothesis is accepted, if it is lower the Null Hypothesis is rejected. ​This is called the decision rule. Once the decision rule has been presented, interpretation of the results of the hypothesis test is then provided. When performing hypothesis testing about the population mean, the sample mean is estimated which can be compared to the hypothesized mean to further support the interpretation of the results of the hypothesis test.

µ (Population mean) = Average Relative Skill of your team

H0 (Null Hypothesis) = µ < 1342 (Average relative skill of your team is less than 1342)

Ha (Alternate Hypothesis)= µ > 1342 (Average relative skill of your team is greater than 1342)

α (Level of Significance) = 0.05

| **Statistic** | **Value** |
| --- | --- |
| Test Statistic | 167.13  *\*Round off to 2 decimal places.* |
| P-value | 0.0  *\*Round off to 4 decimal places.* |

P-Value 0.0 < α 0.05.   
  
Since the P-Value is less than the Significance level the Null Hypothesis is rejected. The Alternate Hypothesis holds true. The Average relative skill of your team is greater than 1342.

# Hypothesis Test for the Population Mean (II)

µ (Population mean) = Average number of points scored by your team between 2013-2015

H0 (Null Hypothesis) = µ > 110 (Average points scored is greater than 110)

Ha (Alternate Hypothesis)= µ < 110 (Average points scored is less than 110)

α (Level of Significance) = 0.01

| **Statistic** | **Value** |
| --- | --- |
| Test Statistic | -8.66  *\*Round off to 2 decimal places.* |
| P-value | 0.0  *\*Round off to 4 decimal places.* |

P-Value 0.0 < α 0.01.   
  
Since the P-Value is less than the Significance level the Null Hypothesis is rejected. The Alternate Hypothesis holds true. The Average points scored by your team is less than 110.

# Hypothesis Test for the Population Proportion

A one sample Hypothesis testing ​procedure can also be used to test claims about a population proportion as compared to a claim against it. ​The variable of interest here is discrete, where a proportion can be calculated for the total counts. A proportion is a value between 0 and 1. Just as in the case for one-sample hypothesis testing for the population mean, a null hypothesis as well as an alternative hypothesis are stated. After determining the Null and Alternative Hypothesis a Z-Test can be used to determine the validity of the claim​ where the calculated p-value is compared to the significance level.  ​Using software, the test statistic, p-value and estimate of the proportion are reported. If the p-value is less than the significance level, reject the null hypothesis. We fail to reject the null hypothesis otherwise. The estimated proportion is compared to the hypothesized proportion to support and used to support the results of the hypothesis test.

p (Population proportion) = Proportion of games Team won when scoring 80 or more points

H0 (Null Hypothesis) = p = 0.50 (Proportion of games meeting this condition is 0.50)

Ha (Alternate Hypothesis)= p ≠ 0.50 (Proportion of games won is not 0.50)

α (Level of Significance) = 0.05

| **Statistic** | **Value** |
| --- | --- |
| Test Statistic | 7.25  *\*Round off to 2 decimal places.* |
| P-value | 0.0  *\*Round off to 4 decimal places.* |

P-Value 0.0 < α 0.05.   
  
Since the P-Value is less than the Significance level the Null Hypothesis is rejected. The Alternate Hypothesis holds true. The proportion of games your Team won when scoring 80 or more points was not 0.50.

# Hypothesis Test for the Difference Between Two Population Means

A two sample Hypothesis testing procedure can be used to assess a claim about two population averages. When the standard deviation of a population is known z-tests are used. We do not know the standard deviation of this population so we will use a t-test. There are two types of t-tests for testing the difference of two population means; A paired and unpaired test. A paired test is when one population is exposed to two treatments, with measurements from the same group before and after. An unpaired t-test is when samples are taken from two unrelated populations and compared. Since the 1996-1998 Bulls cannot be considered the same population as the 2013-2015 Spurs, an unpaired t-test is being used. As before a Null and Alternative Hypothesis are established and tested with a stated level of significance. Statistical software is then used to determine the p-value of this claim to reject or accept the Null Hypothesis.

µ1 (Population mean of your team) = Average Relative Skill of Spurs

µ2 (Population mean of assigned team) = Average Relative Skill of Bulls

H0 (Null Hypothesis) = µ1 = µ2 (Average Relative Skill of Spurs is equal to the Bulls)

Ha (Alternate Hypothesis)= µ1 ≠ µ2 (Average Relative Skill of Spurs is not equal to the Bulls)

α (Level of Significance) = 0.01

| **Statistic** | **Value** |
| --- | --- |
| Test Statistic | 14.04  *\*Round off to 2 decimal places.* |
| P-value | 0.0  *\*Round off to 4 decimal places.* |

P-Value 0.0 < α 0.01.   
  
Since the P-Value is less than the Significance level the Null Hypothesis is rejected. The average relative skill of the Spurs is not that of the Bulls.

# Conclusion

These tests all compared the 2013-2015 Spurs to the 1996-1998 Bulls. These tests determined the following answers. The average relative skill level of the Spurs in 2013-2015 is greater than 1342. The Spurs at an average of less than 110 points between 2013-2015. The Spurs did not score 80 or more points 50% of the time when a game is won. The Spurs from 2013-2015 did not have the same Relative Skill Level as the Chicago Bulls in 1996-1998.