# MAT 243 Project Two Summary Report

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## Introduction: Problem Statement

The problem addressed in this project is to determine if the Celtics; during the 2013 – 2015 seasons; displayed statistical patterns that could be evaluated using hypothesis testing. Specifically, examining claims about the team’s relative skill level, average points scored, winning proportions when scoring above a threshold, and how the team compares against an historically successful 1996 – 1998 Chicago Bulls team. The dataset used for this project includes NBA statistics from various teams over different seasons with a focus on performance metrics such as; points scored [‘pts’], relative skill [‘elo\_n’], and game outcomes [;game-result’]. These statistical methods applied include; one-sample and two-sample t-tests along with proportions z-test. These allow us to evaluate whether the Celtics’ performance metrics support or contradict specific hypotheses using statistical evidence.

## Introduction: Your Team and the Assigned Team

Table 1. Information on the Teams

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

## Hypothesis Test for the Population Mean (I)

Hypothesis testing is a statistical method used to determine whether there is enough evidence in a sample of data to support or refute a specific claim about a population parameter. In this case, the management of the Celtics hypothesized that the team’s average relative skill level during the 2013 – 2015 was greater than 1340. Because the population standard deviation was unknown, a one-sample t-test was used.

The null hypothesis; H0; states that the population men relative skill level is less than or equal to 1340; population mean <= 1340; while the alternative hypothesis; H1; claims that the population mean for relative skill is greater than 1340. Using an 5% significance level; alpha = 0.05; the following statistics were evaluated.

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

| **Statistic** | **Value** |
| --- | --- |
| Test Statistic | 28.05 |
| P-value | 0.0000 |

Since the P-Value is less than the significance level; the null hypothesis is rejected in support of the alternative hypothesis; Celtics’ relative skill was greater than 1340. This has practical importance because it showcases the team performed above what is considered a critically low skill threshold.

## Hypothesis Test for the Population Mean (II)

To test whether the Celtics’ scored fewer than 106 points on average between 2013 – 2015, a one-sample t-test was conducted with the null hypothesis; H0: mean >= 106; using a 1% significance level.

Since the P-Value is less than the significance level; the null hypothesis is rejected in support of the alternative hypothesis as the Celtics’ averaged less than the hypothesized average of 106 points. This insight could be important for adjusting offensive strategies or setting performance expectations.

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

| **Statistic** | **Value** |
| --- | --- |
| Test Statistic | 98.05 |
| P-value | 0.0000 |

## Hypothesis Test for the Population Proportion

The Celtics’ management claimed that they won 90% of games when scoring more than 102 points. To test this, a one-proportion z-test was performed. The null hypothesis; H0: p = 0.90; assumes the true proportion is 0.90, while the alternative hypothesis; H1: p != 0.90; tests for a difference.

Table 4: Hypothesis Test for the Population Proportion

| **Statistic** | **Value** |
| --- | --- |
| Test Statistic | -4.26 |
| P-value | 0.0000  Actual: 0.00002043 |

The P-Value is less than the significance level of 0.05; the null hypothesis is rejected in favor of the alternative hypothesis. There is enough statistical evidence to support the claim that the Celtics’ won less than 90% of their games when scoring more than 102 points, the proportion of games won when scoring above 102 is 67.90&; significant delta from 90%.

## Hypothesis Test for the Difference Between Two Population Means

To compare the Celtics’ 2013 – 2015 seasons to the Bulls’ 1996 – 1998 seasons in terms of skill level. A two-tailed t-test was conducted to determine the difference in means. The null hypothesis; H0: mean 1 = mean 2; states that the two teams have the same relative skill level, while the alternative hypothesis; H1: mean 1 != mean 2; states that a difference does exist.

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

| **Statistic** | **Value** |
| --- | --- |
| Test Statistic | 53.41 |
| P-value | 0.0000 |

Since the P-Value is less than the significance level, the null hypothesis is rejected in support of the alternative hypothesis; there is strong statistical evidence that the Celtics’ average skill level for the 2013 – 2015 seasons was significantly different from the Bull’s 1996 – 1998 seasons. Given the direction and size of the test statistic, this suggests the Bulls were markedly stronger in terms of relative skill than the Celtics.

## Conclusion

The statistical analyses performed throughout this project provided concrete, data-driven insights into the Celtics’ performance between 2013 and 2015. The team showed a statistically significant skill level above a low-performance benchmark and scored significantly fewer than 106 points on average, supporting the coach’s concerns. However, there was insufficient evidence to disprove the claim that they won 90% of games when scoring over 102 points. Lastly, a strong, statistically significant difference in skill level was found when compared to the Bulls of the late 1990s. These results are practically meaningful for both evaluating past performance and planning future team strategies.