# MAT 243 Project One Summary Report

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## Introduction: Problem Statement

The Chicago Bulls are considered one of the best NBA teams during the 1990s, mainly due to the fact that they won the championship 3 years in a row – TWICE! The second threepeat happened during the 1996-1998 seasons. This period also coincides with Michael Jordan’s return to the Bulls. Because of the 2 threepeats and the return of one of the top NBA players, comparing another NBA team to this high performing team can be quite illuminating.

For this comparative analysis the 2013-2015 San Antonio Spurs were selected. The Spurs won a championship, placed second, and finished 6th within this period. However, earlier in the 2000s the Spurs placed first or second 4 out of 5 years. So how does a post-Tim Duncan/David Robinson Spurs compare to a Michael Jordan-era Bulls – this analysis attempts to answer that.

The main metrics used to compare the teams will be points scored in a game and the Elo “…a simple measure of strength based on game-by-game results” (FiveThirtyEight, 2022). The higher an Elo rating the better a team has performed. Silver and Fischer-Baum (2015) have created this table to illustrate the range of Elo values for the NBA:

Table

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Figure 1: NBA Elo Ratings Brackets (Silver and Fischer-Baum, 2015)

## Introduction: Your Team and the Assigned Team

Table 1. Information on the Teams

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

## Data Visualization: Points Scored by Spurs

Since an NBA game is a scored in points with a winner having the most points, it is logical to look at the points scored by the Spurs during the 2013-2015 period. Because the period of 2013-2015 is being looked at wholistically, i.e., not a year-by-year analysis, it is best to view the points as a composite histogram, Figure 2.

Chart, histogram

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Figure 2: Points Scored by the Spurs

Based on the histogram the distribution appears to be quite normally distributed around the mean of 103.9 points per game.

The same data could be viewed on a scatter plot but the scatter plot does not show how often a score reoccurs. For example, the Spurs score between 97.5 and 100 points about 30 times – on a scatter plot this might be a single point. What a scatter plot with a best fit line could show better than a histogram is how the mean per year changes, i.e., is the team scoring more year on year.

## Data Visualization: Points Scored by the Assigned Team

As before the Bulls are being analyzed wholistically within the 1996-1998 period. Their histogram is shown in Figure 3.

Chart, histogram

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Figure 3: Points scored by the Bulls

Again, the histogram appears to be normal but perhaps with slightly lower normality - the data may be skewed to the left (a box and whisker plot may help to understand the normality). The distribution is centered around the mean of 101.7 points – which is 2.1 points below the Spurs.

Within the NBA, home-court advantage typically brings a 3-to-4-point advantage (Silver and Fischer-Baum, 2015); Figures 2 and 3 are for all games.

## Data Visualization: Comparing the Two Teams

It is easy to say that since the Spurs’ mean was higher, they must be the better team, but it is not that simple. How the data is distributed, e.g., normality, and how much variability is there within the data is also important. Looking at a comparative box plot allows you to quickly compare these ideas.

Chart, box and whisker chart

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Figure 4: Box plot Showing the Teams’ Points Distribution

As mentioned before the Spurs have a higher average score than the Bulls which is shown. The Q3 and Q1 are also greater for the Spurs – meaning 50% of the time the Spurs’ will end a game with a score greater than the Bulls’.

From the comparative box plots both the Bulls’ and Spurs’ distributions do appear to be normally distributed as the mean is situated evenly within the box and the whiskers are not greatly skewed at either extrema.

The boxes also show that the Bulls’ have more variability within their scoring – the span of the maximum and minimum are larger than the Spurs’. The IQR is also larger (size of the box) for the Bulls suggesting that they also have a greater standard deviation in their scores.

It must be pointed out that the Spurs have at least one outlier (diamond above 130 points) and should be considered as an anomaly in any further analysis.

## Descriptive Statistics: Points Scored By Spurs in Home Games

Table 2. Descriptive Statistics for Points Scored by Spurs in Home Games

| **Statistic Name** | **Value (points)** |
| --- | --- |
| Mean | 106.12 |
| Median | 105.0 |
| Variance | 107.16 |
| Standard Deviation | 10.35 |

The mean is the average of the data – it shows the center of the data but is subject to being skewed by extremes. That is, if the majority of the data is near a value but a single data is very far from this value the mean will shift in the direction of that extreme value.

The median is the middle number once the list of scores is sorted. The median is not as sensitive to extreme values and their effect on skewing as the mean. Because the median is less than the mean, the data is skewed to the left. Due to this skewing the median may be more representative of the home games.

The variance is the average of the square difference from the mean. The larger the variance the larger the spread of data.

The standard deviation is the square root of the variance. Standard deviation is useful within a normal distribution as cumulative probability is a function of standard deviation, i.e., plus or minus one sigma is 68%, two sigma is 95%, etc.

## Descriptive Statistics: Points Scored by Spurs in Away Games

Table 3. Descriptive Statistics for Points Scored by Spurs in Away Games

| **Statistic Name** | **Value (points)** |
| --- | --- |
| Mean | 101.59 |
| Median | 101.0 |
| Variance | 131.31 |
| Standard Deviation | 11.46 |

Unlike the home games this distribution has a higher normality which is shown by the mean and the median very close together. In a perfectly normal distribution, the mean and the median would be the same value.

The away games show a much higher variance than the home games. This means there is more *spread* in the expected points the Spurs might obtain in an away game versus a home game. The away games also are lower scoring in both the mean and median.

## Confidence Intervals for the Average Relative Skill of All Teams in 2013 - 2015

Table 4. Confidence Interval for Average Relative Skill of All Teams in 2013 - 2015

| **Confidence Level (%)** | **Elo Confidence Interval** |
| --- | --- |
| 95% Confidence | [1502.02, 1507.18] |

Based on this confidence range 95% of the time any team in the NBA in the 2013-2015 seasons will produce an Elo score of 1502 – 1507. 2.5% of the time the score will be greater and 2.5% of the time it will be lower.

To encompass more probability, i.e., 99% confidence, the interval will widen and conversely to be less confident, i.e., 90%, the interval will shrink.

Within the same time period there is also a 94.5% chance that any other team will obtain an Elo less than Spurs. This makes sense when looking at the 95% confidence range for the Spurs: [1682.84 – 1688].

## Confidence Intervals for the Average Relative Skill of All Teams in 1996 - 1998

Table 5. Confidence Interval for Average Relative Skill of Teams in Assigned Team’s Years

| **Confidence Level (%)** | **Elo Confidence Interval of Elo** |
| --- | --- |
| 95% | [1487.66, 1493.65] |

Based on confidence range 95% of the time any team in the NBA in the 1996-1998 period will produce an Elo score of ~1488 – 1494. 2.5% of the time the Elo score will be greater and 2.5% of the time it will be lower. A confidence interval of 99% would result in a wider range of Elo scores and a lower interval, i.e., 90%, in a narrower range.

This range is lower than the 2013-2015 Elo confidence range from the comparative Spurs. This might suggest that the teams in the 2013-2015 seasons are “stronger” than the teams in the 1996-1998 seasons. However, the Bulls’ confidence range is [1738.8, 1742.79]. This is much greater than the all of the teams within the NBA – which is not surprising given that the Bulls won the championship each year.

Moreover, the Bulls’ Elo confidence range is also greater than the Spurs’. While these may not be directly compared (Elo is zero-sum metric), the difference between the league’s Elo and the respective teams can be used as a comparison of dominance.

* Spurs have a dominance of 180.8 (1682.84 – 1502.02)
* Bulls have a dominance of 251.1 (1738.8 – 1487.66)

So even though the teams were stronger during the 2013-2015 seasons the Spurs did not dominate the league in the same way the Bulls did during the 1996 – 1998 seasons.

## Conclusion

In comparing the 2013-2015 Spurs to the 1996-1998 Bulls the Elo and points distribution were employed. The points distribution suggests the Spurs, as shown in Figure 4, score more on average and have lower variability in the scores they produce.

The Spurs do not perform as well in away games as in home games. While this is expected the Spurs perform below expectation with an away-game deficit of 4.53 points (106.12 – 101.59) where the league average deficit is 3.5 points. The fact that the home games are skewed to the left, and the away games are not, further suggests that the home games may be the abnormal result, i.e., they are scoring more at home more than expected. There is also an outlier score that potentially occurred at a home game.

This uneven performance between home and away games would have lowered their Elo scores.

In the end, once the 95% confidence ranges are computed and compared to their respective league ranges, the Bulls are shown to be much more dominate. This analysis suggests what most people suspect – the Jordan Bulls are the best team of all time.

## Citations

FiveThirtyEight. (2022, June 17). *The complete history of the NBA*. <https://projects.fivethirtyeight.com/complete-history-of-the-nba>

Silver, N. and Fischer-Baum, R. (2015, May 21). *How we calculate NBA Elo ratings*. FiveThirtyEight. <https://fivethirtyeight.com/features/how-we-calculate-nba-elo-ratings/>