

Ⓐ Milestone 4 | NBA Performance Analysis

INTRODUCTION: Stats for players and teams have long been a part of professional sports, but since the 2000s, data analytics has become an increasingly important part of developing and running a successful sports team. This revolution in data has also resulted in new ways of measuring what it means for a player or team to be effective.

In this Milestone, you'll take a shot at being a sports analyst! You'll explore how NBA team performance and playing styles have changed over the past seventeen seasons. Using real data, you'll uncover trends in scoring, shot selection, and strategy. As a data analyst supporting a coaching staff, your goal is to identify patterns tied to team success and make evidence-based recommendations. Your insights could help inform decisions around training, resource allocation, and game strategy—just like in a real-world analytics role.

If you're feeling a little rusty on the details of professional basketball, here's how it's played:

A game of basketball is played between two teams, each with five players. The objective is to score more points than the opposing team by shooting a ball through a hoop/basket. Players can score for their team in a variety of ways – point values are assigned to the location of the shot.

A basket made from inside the "three-point line" is worth two points, while a shot made from beyond the line is worth three points. "Free throws" can also be awarded to a player or a team when the opposing team commits a foul or breaks a rule. These are worth one point each.

HOW IT WORKS: Follow the prompts in the questions below to investigate your data. Post your answers in the provided boxes: the **yellow boxes** for the queries you write and **blue boxes** for text-based answers. When you're done, export your

document as a pdf file and submit it on the Milestone page – see instructions for creating a PDF at the end of the Milestone. Please don't ever remove (paste your query below ) or (write your **answer** below ). These help your Evaluator!

SQL App: [Here's that link](#) to our specialized SQL app, where you'll write your SQL queries and interact with the data.

– Data Set Description

The NBA games dataset (`nba.games`) contains information about 23 335 games played from the 2004 season through the 2020 season. There are eighteen columns in the dataset, of which the following will be used in the Milestone:

- **season** – Starting year for the season the game was played. For example, games that are part of the 2010–11 season will have a season value of 2010, even if they are played in 2021.
- **team_home, team_away** – Full name of the home and visiting teams, respectively. Names will always reflect their current franchise names, even if they were known by a different name in prior years.
- **pts_home, pts_away** – Number of points scored by the home and visiting teams, respectively, in each game.
- **home_team_win** – Flag indicating whether the home team won (1) or the visiting team won (0).
- **pct_3p_home, pct_3p_away** – Percentage of 3 point shots made by the home team and away team, respectively.

– Task 1: Game Statistics Trends Over Time

- A. Start by calculating the total number of rows and the first & last seasons in the dataset.

HINT: This should be done in one query. If done correctly, the number of games is 23 335, the first season represented is 2004, and the last season represented is 2020.

(paste your query below )

```
SELECT
    COUNT(*) AS total_games,
    MIN(season) AS first_season,
    MAX(season) AS last_season
FROM nba.games
```

- B. Write a query that returns the average score from the home team, away team, and the average of the `home_team_win` column.

(paste your query below )

```
SELECT
    AVG(pts_home) AS avg_home_score,
    AVG(pts_away) AS avg_away_score,
    AVG(home_team_win) AS home_win_rate
FROM nba.games
```

The average of the `home_team_win` column can be interpreted as the win rate for the home team. What do these values tell you about what you can expect from the result of a random NBA game?

(write your **answer** below 

This tells us that in a random NBA game, the home team has a statistical advantage and is more likely to win than the away team. This is consistent with the well-known phenomenon of

home-court advantage, where factors like crowd support, familiarity with the court, and reduced travel fatigue tend to benefit the home team.

- C. Modify your query from part B, so that the average scores from the home team, away team, and the home team win rate are grouped by each NBA season. Sort your output so that the seasons are ordered chronologically.

(paste your query below )

```
SELECT
    season,
    ROUND(AVG(pts_home), 2) AS avg_home_score,
    ROUND(AVG(pts_away), 2) AS avg_away_score,
    ROUND(AVG(home_team_win), 3) AS home_win_rate
FROM nba.games
GROUP BY season
ORDER BY season
```

What can you say about the trend in these values over the years?

(write your answer below )

Over the years, the data shows a clear increase in average points scored by both home and away teams. This suggests that NBA games have become higher-scoring over time, which could reflect a shift in playing style—such as faster pace, more offensive possessions, and increased emphasis on high-efficiency shots like three-pointers and layups.

At the same time, the home team win rate has shown a gradual decline. While home teams still win more often than away teams, the margin has narrowed slightly.

- D. As a data analyst, your job isn't just to observe patterns—it's to help others understand the story behind the data. Now that you've identified a trend in home team win rates over time, it's time to dig deeper into why this might be happening.



Try this prompt: I discovered that NBA home teams win most of their games, but this percentage has been declining over the years. What factors could account for this trend?

Based on ChatGPT's response, what's one possible explanation for the decline in home-court advantage?

(write your **answer** below 

One possible explanation for the decline in home-court advantage is the rise of advanced technology and analytics, which has leveled the playing field. Teams now use detailed game footage, player tracking, and data analysis to prepare more effectively for road games. This reduces the edge that home teams once had due to unfamiliarity or lack of preparation by the visiting team.

- E. Add two more summaries to your query from part C, to get the average 3-point shot rate for both away and home teams.

(paste your query below )

```
SELECT
    season,
    ROUND(AVG(pts_home), 2) AS avg_home_score,
    ROUND(AVG(pts_away), 2) AS avg_away_score,
    ROUND(AVG(home_team_win), 3) AS home_win_rate,
    ROUND(AVG(pct_3p_home), 3) AS avg_3p_home,
    ROUND(AVG(pct_3p_away), 3) AS avg_3p_away
FROM nba.games
GROUP BY season
ORDER BY season
```

Do these values change over time?

(write your **answer** below )

The average home score, home win rate and away score values increase over time. The average 3 point away value increases at a small rate and the average 3 point at home value stabilizes at around 0.35.

– Task 2: Investigating 3-point Shooting

The average three-point shot rate is about 35.4% over the entire dataset. Let's write some queries to investigate just how important a high three-point shot rate is in terms of winning games.

- A. Write a query that returns the average home team win rate and average three-point percentage at home grouped by home team name and season.

Note: You will not be looking at the away team in this analysis. If done correctly, your query should result in a table with 510 rows.

(paste your query below )

```
SELECT
    team_home,
    season,
    ROUND(AVG(home_team_win), 3) AS home_win_rate,
    ROUND(AVG(pct_3p_home), 3) AS avg_3p_home
FROM nba.games
GROUP BY team_home, season
```

B. Modify your query so we are only looking at results from 2018 or later.

Remember, the season column is a text field - don't forget your quotes! (This should reduce your results down to 90 rows.)

(paste your query below )

```
SELECT
    team_home,
    season,
    ROUND(AVG(home_team_win), 3) AS home_win_rate,
    ROUND(AVG(pct_3p_home), 3) AS avg_3p_home
FROM nba.games
WHERE season >= '2018'
GROUP BY team_home, season
```

C. Add another expression to your query to answer the following question: How many teams had a three-point shot rate of at least 37% (i.e. 0.37)? **HINT:** You'll get this from the output of the SQL app interface, rather than directly from the query.



Try this prompt: I need to modify this SQL query to count how many teams had an average three-point shooting percentage of at least 37% (0.37) from 2018 onward:
<INSERT QUERY FROM 2B> How should I adjust my query to return only teams that meet this threshold, and should I use HAVING or WHERE to apply the filter?

(paste your query below ⤵)

```
SELECT
    team_home,
    season,
    ROUND(AVG(home_team_win), 3) AS home_win_rate,
    ROUND(AVG(pct_3p_home), 3) AS avg_3p_home
FROM nba.games
WHERE season >= '2018'
GROUP BY team_home, season
HAVING AVG(pct_3p_home) >= 0.37
```

(write your answer below ⤵)

25 teams had a three-point shot rate of at least 37%.

- D. Add an additional condition to your query to filter to teams with a losing record (win rate < 0.5), in addition to having a high three-point shot rate.

(paste your query below ⤵)

```
SELECT
    team_home,
    season,
    ROUND(AVG(home_team_win), 3) AS home_win_rate,
    ROUND(AVG(pct_3p_home), 3) AS avg_3p_home
FROM nba.games
```

```
WHERE season >= '2018'  
GROUP BY team_home, season  
HAVING AVG(pct_3p_home) >= 0.37 AND AVG(home_team_win) < 0.5
```

How many teams had a losing record while having a high 3-point shot percentage? (As with the previous part, you'll read this from the SQL app interface instead of directly from the query.)

(write your **answer** below )

2 teams had a high losing record while having a high 3-point shot percentage

- E. Repeat parts C and D, but this time filtering to teams that had a low 3-point shooting rate of 34% (0.34) or less.

How many teams had this low of a 3-point accuracy, and how many of these teams had a losing record? (Paste only the query that answers the last question into the query box.)

(paste your query below )

```
SELECT  
    team_home,  
    season,  
    ROUND(AVG(home_team_win), 3) AS home_win_rate,  
    ROUND(AVG(pct_3p_home), 3) AS avg_3p_home  
FROM nba.games  
WHERE season >= '2018'  
GROUP BY team_home, season  
HAVING AVG(pct_3p_home) <= 0.34 AND AVG(home_team_win) < 0.5
```

(write your **answer** below )

11 teams had a low 3-point accuracy 7 of the teams had a losing record.

- F.** What conclusions can you draw from your analysis in the previous Parts regarding the relationship between 3-point shot rates and team success?

(write your **answer** below )

From the analysis, we can draw a clear conclusion that higher 3-point shooting accuracy tends to be associated with greater team success. Teams that had a 3-point shooting percentage of 37% or higher often had winning records, while many of the teams with a percentage of 34% or lower struggled and ended the season with losing records. This suggests that in today's NBA, where spacing the floor and efficient long-range shooting are key strategic priorities, being effective from beyond the arc can significantly improve a team's chances of winning. On the other hand, poor 3-point shooting may limit offensive efficiency, making it harder to keep up with opponents who excel in that area. While strong 3-point shooting isn't the only factor that determines success, it has become an increasingly important part of modern basketball strategy.

- G.** You've started to explore how 3-point shooting relates to team success—but basketball strategy is complex, and winning teams often rely on more than one approach.



Try this prompt: Are there successful NBA teams that don't rely heavily on three-point shooting? What other strategies might they use to win games?

Based on ChatGPT's response, what other metrics should we investigate to get a more complete picture of team success?

(write your **answer** below 

While 3-point shooting has become a major factor in team success, there are also several other strategies that winning NBA teams use to gain an edge. Some successful teams do not rely heavily on the three-point shot but instead focus on other aspects of the game. For example, strong defensive performance—such as limiting opponents' scoring, generating steals, and contesting shots—can play a critical role in winning games. Rebounding, particularly offensive rebounding, is another key factor, as it creates second-chance scoring opportunities. Additionally, efficient ball movement, measured through high assist rates and low turnover rates, contributes to better shot selection and scoring efficiency. Teams that score effectively in the paint through high-percentage two-point shots can also win consistently without depending on long-range shooting. To get a more complete picture of what leads to team success, analysts should examine metrics related to defense, rebounding, assist-to-turnover ratio, and inside scoring alongside three-point shooting statistics.

– **LevelUp:** Building the Team Stats table

Most of the time when working with data, you will have to build summary tables yourself. This is done to alleviate storage costs, especially since these tables have to constantly be updated via a SQL query. In this LevelUp you'll create two summary tables, one for the home team and one for the away team. Although you don't have the ability to join these tables (yet!), you can come back to this LevelUp and create the full table once you have learned how to join data.

- A.** Write a query that returns the average number of home points scored, average 3 point percentage for the home team, and the number of wins for each team and season combination in the nba.games table.

HINT: You should get a table with 510 rows.

(paste your query below )

```
SELECT
    team_home AS team,
    season,
    ROUND(AVG(pts_home), 2) AS avg_home_points,
    ROUND(AVG(pct_3p_home), 3) AS avg_3p_pct_home,
    SUM(home_team_win) AS total_home_wins
FROM nba.games
GROUP BY team_home, season
ORDER BY season, team
```

- B.** Repeat Part A for the **away** team. You will have to be creative to calculate the number of away wins since the table only tells you whether or not the home team won the game.

If done correctly, your query should result in a table with 510 rows.

(paste your query below )

```
SELECT
    team_away AS team,
    season,
    ROUND(AVG(pts_away), 2) AS avg_away_points,
    ROUND(AVG(pct_3p_away), 3) AS avg_3p_pct_away,
    SUM(1 - home_team_win) AS total_away_wins
FROM nba.games
GROUP BY team_away, season
ORDER BY season, team
```

– Submission

Great work completing this Milestone! To submit your completed Milestone, you will need to download / export this document as a PDF and then upload it to the Milestone submission page. You can find the option to download as a PDF from the File menu in the upper-left corner of the Google Doc interface.