✅ **Milestone 5** | NBA Statistics

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.

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.

RESOURCES: If you need hints on the Milestone or are feeling stuck, there are multiple ways of getting help. Attend Drop-In Hours to work on these problems with your peers, or reach out to the HelpHub if you have questions. Good luck!

PROMPT: In this Milestone, you'll be looking at the way that professional basketball in the NBA has changed over seventeen recent seasons. If you were a coach in the league, what could you say about how the game is being played, and what are the most successful teams doing to be successful?

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
    *
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.

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?

(paste your query below 👇)

```
SELECT
    ROUND(AVG(pts_home), 0) as home,
    ROUND(AVG(pts_away), 0) as away,
    ROUND(AVG(home_team_win), 2) as wins
```

```
FROM
   nba.games
```

(write your **answer** below 👇)

I found that the average points scored for the home team is 103pts. The away team had an average of 100pts scored. I also found that our home team wins about 59% of the time. These results tell me that if I would go to a random NBA game, I can expect to see the scoreboard reach at least 100 points for each team. It also seems that there is almost a 50/50 chance of either team winning. This was interesting to me as I feel like I always hear how one team is better than another due to certain players, but based on these results it seems that's not the case fully.

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.

What can you say about the trend in these values over the years?
(paste your query below 👇)

```
SELECT
   ROUND(AVG(pts_home), 0) as home,
   ROUND(AVG(pts_away), 0) as away,
   ROUND(AVG(home_team_win), 3) as wins
FROM
   nba.games
GROUP BY
   season
ORDER BY
```

```
        substring(season, 1, 4),
        substring(season, 5, 1)
```

(write your **answer** below 👇)

I was returned 17 seasons total after running the above query. Looking at the results, I can see that the number of points scored by both teams has increased by 10–20pts per team. I also see a decrease in the home team win percentage. It looks like the home team used to win around 60% of the time and now it's more around 50%.

D. Add two more summaries to your query from part C, to get the average 3–point shot rate for both away and home teams. Do these values change over time?

(paste your query below 👇)

```
SELECT
    ROUND(AVG(pts_home), 0) as home,
    ROUND(AVG(pts_away), 0) as away,
    ROUND(AVG(home_team_win), 3) as wins,
    ROUND(AVG(pct_3p_away), 3) as three_home,
    ROUND(AVG(pct_3p_home), 3) as three_away
FROM
    nba.games
GROUP BY
    season
ORDER BY
    substring(season, 1, 4),
    substring(season, 5, 1)
```

(write your **answer** below 👇)

After adding these two additional lines to the query, I am able to see the rate for 3-point shots is about 35% for both teams. This rate seems to stay very consistent across all seasons.

— 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_name,
    season,
    ROUND(AVG(home_team_win), 3) as wins,
    ROUND(AVG(pct_3p_home), 3) as three_pts
FROM
    nba.games,
    nba.teams
GROUP BY
    season,
    team_name
ORDER BY
    substring(season, 1, 4),
    substring(season, 5, 1)
```

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_name,
    season,
    ROUND(AVG(home_team_win), 3) as wins,
    ROUND(AVG(pct_3p_home), 3) as three_pts
FROM
    nba.games,
    nba.teams
WHERE (substring(season, 1, 4)) IN ('2018', '2019', '2020')
GROUP BY
    season,
    team_name
ORDER BY
    substring(season, 1, 4),
    substring(season, 5, 1)
```

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.

(paste your query below 👇)

```
SELECT
    team_name,
    season,
    ROUND(AVG(home_team_win), 3) as wins,
    ROUND(AVG(pct_3p_home), 3) as three_pts_rate
```

```
FROM
   nba.games,
   nba.teams
WHERE (substring(season, 1, 4)) IN ('2018', '2019', '2020')
GROUP BY
   season,
   team_name
ORDER BY
   three_pts_rate DESC
```

(write your **answer** below 👇)

Based on the result of the updated query, it looks like no team has a 3-point shot rate of or higher than 37%. This is for seasons in the year 2018 and after. The highest shot rate for any team is 36.6%.

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.

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.)

(paste your query below 👇)

```
SELECT
   team_name,
   season,
   ROUND(AVG(home_team_win), 3) as wins,
   ROUND(AVG(pct_3p_home), 3) as three_pts_rate
FROM
   nba.games,
   nba.teams
WHERE (substring(season, 1, 4)) IN ('2018', '2019', '2020')
```

```
GROUP BY
    season,
    team_name
ORDER BY
    wins ASC,
    three_pts_rate DESC
```

(write your **answer** below 👇)

After running the above query, teams who played in seasons from
2018 onwards, seem to not have a win percentage less than 54%.
Some of these teams include the New Orleans Pelicans,
Cleveland Cavaliers, Milwaukee Bucks, and so on.

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_name,
    season,
    ROUND(AVG(home_team_win), 3) as wins,
    ROUND(AVG(pct_3p_home), 3) as three_pts_rate
FROM
    nba.games,
    nba.teams
WHERE (substring(season, 1, 4)) IN ('2018', '2019', '2020')
GROUP BY
    season,
```

```
    team_name
ORDER BY
    three_pts_rate ASC
```

(write your **answer** below 👇)

> Once again, there are no teams with a 3-point shooting rate lower than 35.7% for teams who played in NBA seasons in 201 and after. Some of these teams include Orlando Magic, Indiana Pacers, Brooklyn Nets, etc.

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 👇)

> Based on the results from the previous parts, I have found that the teams with a higher win rate also have a lower 3-point shoot rate and vice versa. Essentially, teams who tend to have less wins, happen to have higher 3-point shoot rates.

— 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 👇)

```sql
SELECT
    team_name,
    season,
    ROUND(AVG(pts_home), 0) as home_pts,
    ROUND(AVG(home_team_win), 3) as wins,
    ROUND(AVG(pct_3p_home), 3) as three_pts_rate
FROM
    nba.games,
    nba.teams
GROUP BY
    season,
    team_name
```

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 👇)

```sql
SELECT
    team_name,
    season,
    ROUND(AVG(pts_away), 0) as away_pts,
    ((ROUND(AVG(home_team_win), 3) - 1)* -1) as wins,
    ROUND(AVG(pct_3p_away), 3) as three_pts_rate
FROM
    nba.games,
    nba.teams
```

```
GROUP BY
    season,
    team_name
```

— 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.