

# Basketball Analytics Questionnaire

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Dear (Head of Basketball Strategy & Analytics):

The following analysis is separated into two parts. The first part answers specific queries about the 2018-2019 NBA play-by-play data while the second part compares Lakers season performance in wins and losses.

## Part 1: Data Comprehension

- A. What values in the "EVENTMSGTYPE" column are associated with –
  - a. Made Shots
  - b. Missed Shots

The "EVENTMSGTYPE" column breaks down some of the action in a game into 14 distinct events labeled 1 through 13 and 18. The values associated with made shots are coded as 1 while the values for missed shots are labeled as 2. We can see a quick table below of total number of made shots and total number of missed shots in the entire 2018-2019 NBA season.

Number of Made Shots	Number of Missed Shots
101062	118396

\* EVENTMSGTYPE = 1 (Made) & EVENTMSGTYPE = 2 (Missed)

- B. What was the most common five-man lineup played by each team? Use play clock time (columns: ["PCTIMESTRING", "TIME"]) to rank each lineup. Display the output in a chart of your choosing.

In the data set, we are given the set of players on the floor at each game event for all games. Therefore, we can find the most common five-man lineup for each team by calculating the total time on the floor per unique set of five players. The table below shows the most common five-man lineup per team in the 2018-2019 season.

Team	Player1	Player2	Player3	Player4	Player5	Total Minutes
76ers	Ben Simmons	Joel Embiid	Jimmy Butler	Wilson Chandler	JJ Redick	292.9
Bucks	Malcolm Brogdon	Giannis Antetokounmpo	Khris Middleton	Eric Bledsoe	Brook Lopez	597.4
Bulls	Wendell Carter Jr.	Ryan Arcidiacono	Jabari Parker	Zach LaVine	Justin Holiday	228.6
Cavaliers	Collin Sexton	Ante Zizic	Cedi Osman	Brandon Knight	Kevin Love	125.1
Celtics	Jayson Tatum	Marcus Smart	Marcus Morris	Kyrie Irving	Al Horford	504.3
Clippers	Shai Gilgeous-Alexander	Tobias Harris	Avery Bradley	Danilo Gallinari	Marcin Gortat	348.6
Grizzlies	Jaren Jackson Jr.	Kyle Anderson	Garrett Temple	Marc Gasol	Mike Conley	464.0
Hawks	Trae Young	Kevin Huerter	John Collins	Taurean Prince	Dewayne Dedmon	323.9
Heat	Josh Richardson	Justise Winslow	Rodney McGruder	Hassan Whiteside	James Johnson	162.6
Hornets	Cody Zeller	Jeremy Lamb	Kemba Walker	Nicolas Batum	Marvin Williams	593.0
Jazz	Donovan Mitchell	Joe Ingles	Rudy Gobert	Derrick Favors	Ricky Rubio	500.3
Kings	De'Aaron Fox	Buddy Hield	Willie Cauley-Stein	Iman Shumpert	Nemanja Bjelica	499.8
Knicks	Kevin Knox	Emmanuel Mudiay	Noah Vonleh	Tim Hardaway Jr.	Enes Kanter	166.4
Lakers	Kyle Kuzma	Lonzo Ball	Brandon Ingram	JaVale McGee	LeBron James	233.6
Magic	Jonathan Isaac	Aaron Gordon	Evan Fournier	Nikola Vucevic	D.J. Augustin	864.9
Mavericks	Luka Doncic	Dennis Smith Jr.	Harrison Barnes	Wesley Matthews	DeAndre Jordan	412.1
Nets	Jarrett Allen	Caris LeVert	D'Angelo Russell	Joe Harris	Jared Dudley	189.0
Nuggets	Jamal Murray	Nikola Jokic	Gary Harris	Will Barton	Paul Millsap	429.3
Pacers	Myles Turner	Victor Oladipo	Bojan Bogdanovic	Darren Collison	Thaddeus Young	555.0
Pelicans	Anthony Davis	E'Twaun Moore	Nikola Mirotic	Wesley Johnson	Jrue Holiday	135.9

Team	Player1	Player2	Player3	Player4	Player5	Total Minutes
Pistons	Bruce Brown	Reggie Bullock	Andre Drummond	Reggie Jackson	Blake Griffin	309.2
Raptors	Pascal Siakam	Kawhi Leonard	Danny Green	Serge Ibaka	Kyle Lowry	541.3
Rockets	Clint Capela	James Harden	Eric Gordon	PJ Tucker	Chris Paul	420.6
Spurs	Derrick White	Bryn Forbes	DeMar DeRozan	Rudy Gay	LaMarcus Aldridge	387.0
Suns	Deandre Ayton	De'Anthony Melton	Mikal Bridges	Devin Booker	T.J. Warren	190.9
Thunder	Terrance Ferguson	Jerami Grant	Steven Adams	Paul George	Russell Westbrook	918.6
Timberwolves	Josh Okogie	Karl-Anthony Towns	Tyus Jones	Dario Saric	Andrew Wiggins	299.0
Trail Blazers	Jusuf Nurkic	CJ McCollum	Maurice Harkless	Damian Lillard	Al-Farouq Aminu	743.5
Warriors	Kevon Looney	Draymond Green	Klay Thompson	Stephen Curry	Kevin Durant	312.4
Wizards	Thomas Bryant	Tomas Satoransky	Bradley Beal	Jeff Green	Trevor Ariza	347.1

\* Most common five-man lineup per team by total time on the floor

- C. Which players led the league in three shot fouls drawn in the 4<sup>th</sup> quarter? Which players led the league in and-1s in the 4<sup>th</sup> quarter? Display the top 10 players for both questions in a table or chart of your choosing.

I filtered the play-by-play dataset to only plays in the 4<sup>th</sup> quarter and calculated the total number of times each player shot 3 free throws at the free throw line. A player can only shoot 3 free throw shots if they got fouled shooting a 3 point shot **and** missed the shot. Next, I used the same filtered data and calculated the total number of times each player made a shot while fouled on the play. Excluding technical free throw shots, a player can only shoot 1 free throw at the free throw line if they were fouled **and** made the shot (definition of and-1). The table below displays the top 10 leaders in both statistics.

Player	Num. 4th Quarter 3-Shot Fouls Drawn	Player	Num. 4th Quarter And-1s
James Harden	24	Giannis Antetokounmpo	104
Terrence Ross	11	James Harden	76
Damian Lillard	10	Montrezl Harrell	72

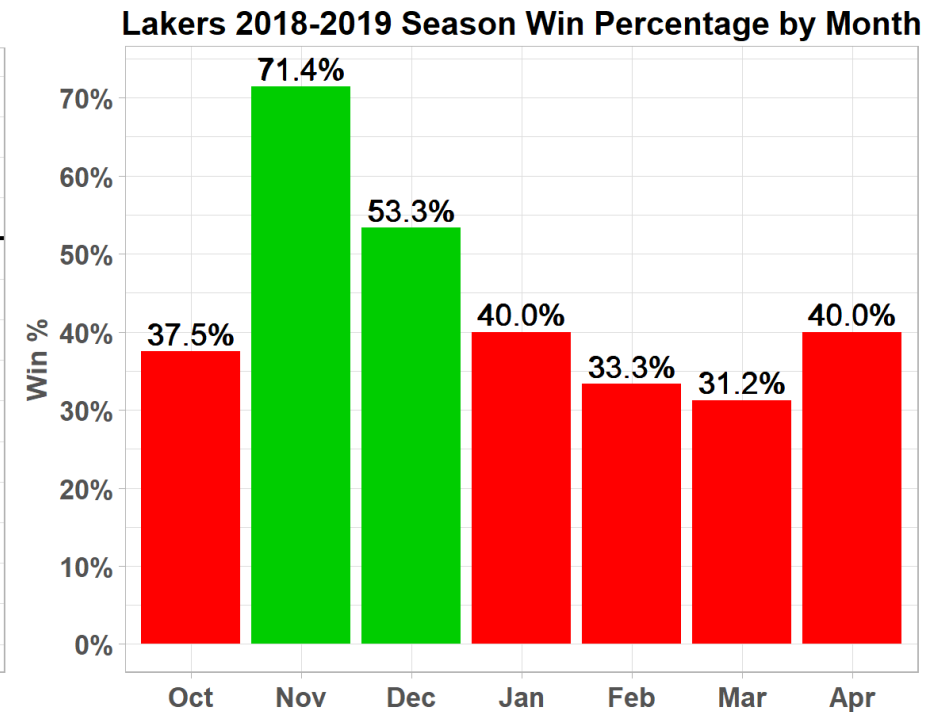
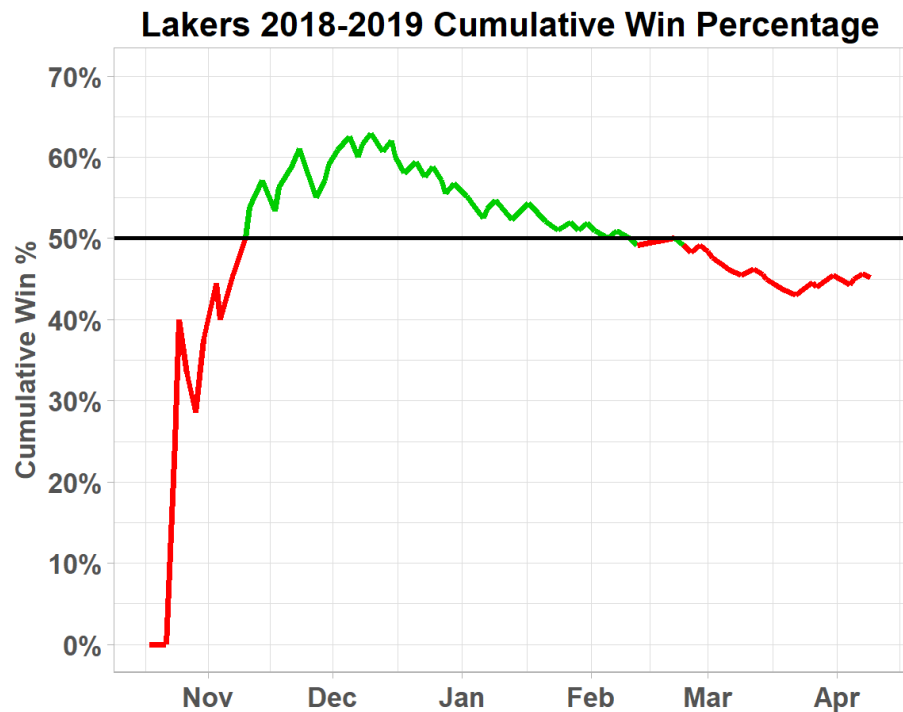
Player	Num. 4th Quarter 3-Shot Fouls Drawn	Player	Num. 4th Quarter And-1s
Kemba Walker	8	Julius Randle	65
JJ Redick	6	DeMar DeRozan	62
D'Angelo Russell	5	LeBron James	59
D.J. Augustin	5	Karl-Anthony Towns	57
Doug McDermott	5	Paul George	57
Lou Williams	5	Blake Griffin	56
Paul George	5	Joel Embiid	55

\* Top 10 4th Quarter 3 Shot Fouls Drawn and 4th Quarter And-1s

## Part 2: Analytical Acumen

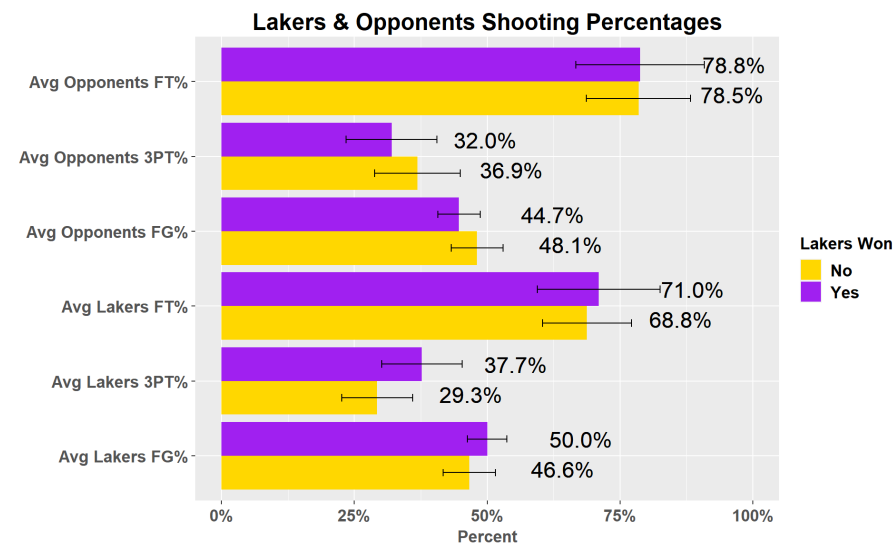
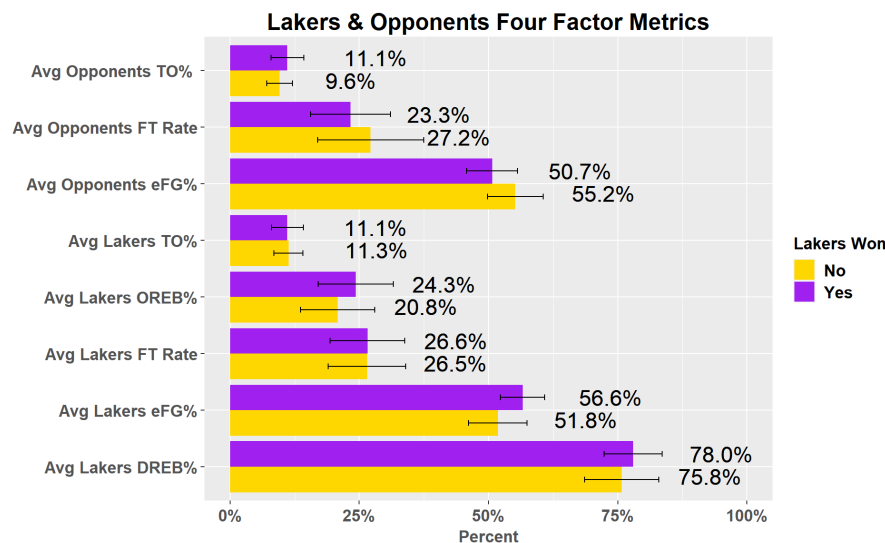
In this second part, we will investigate the 2018-2019 Lakers season, which happened to be LeBron James first season as a member of the team after signing a 4-year \$154 million deal. Specifically, we will look at the team's performance in wins versus losses. In terms of individual players, we will also see correlation between Lakers losses and LeBron James missed games due to injury.

The Lakers finished the season 10<sup>th</sup> seed in the western conference with a record of 37-45. They were 20-14 and 4<sup>th</sup> seed in the west when LeBron James went down with a groin injury on Christmas day. James played in only 55 of the 82 games and Lakers went 9-18 overall without James and 28-27 with James. Many of those losses were also without Lonzo Ball, Josh Hart, and Brandon Ingram. Below shows Lakers cumulative win percentage as a function of time as well as a bar chart representing the Lakers win percentage by month.

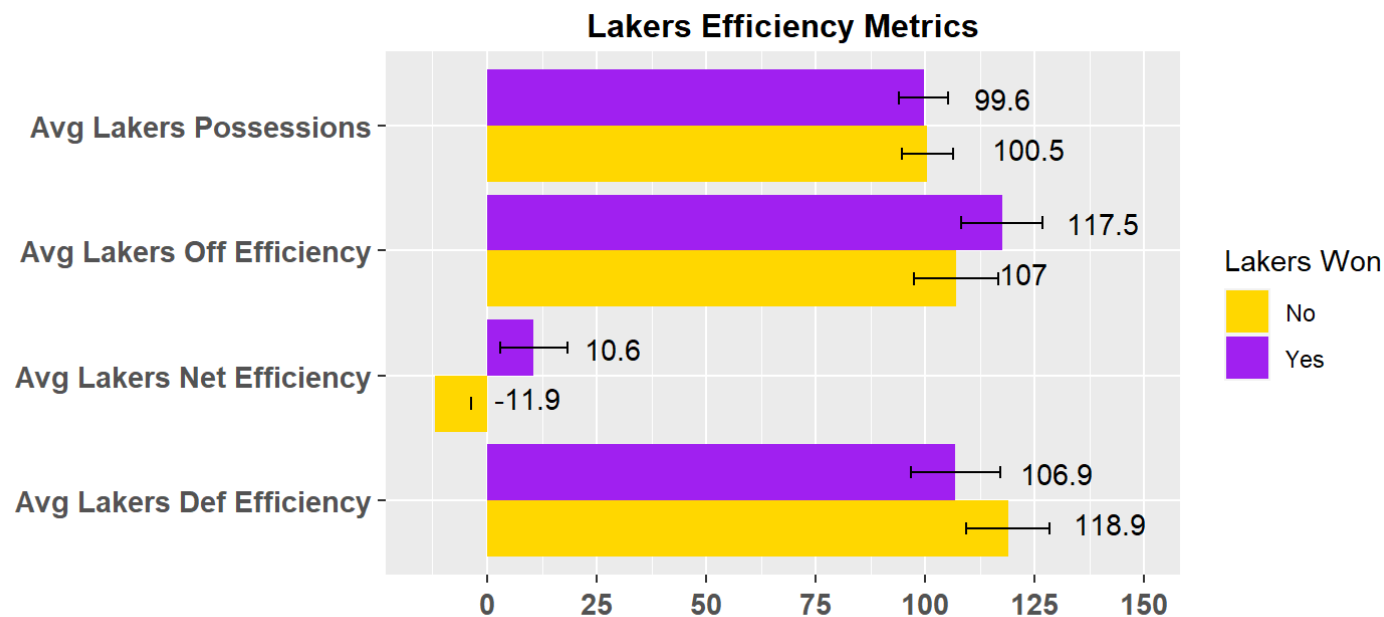


Lakers had a slow start to the season but quickly found their rhythm with their most successful month in November. They kept winning more than they lost up until Christmas day when LeBron James injured his groin and would go on to miss 17 straight games. He would return on January 31st, 2019 vs Clippers but team success did not rebound after his arrival. The Lakers continued to lose more games dropping them out of the playoff picture. Their record fell below .500 in February and were never able to reach .500 again. James also sat out the last six games of the season and although he played well individually after his injury, he never fully recovered at 100% after his return.

In this next few charts, we will look at the four factors of basketball success and shooting percentages by wins and losses for the Lakers and their opponents. The four factors of basketball success include shooting, turnovers, rebounding, and free throws in order of importance to winning. The metrics plotted below are averages across wins and losses but error bars are included to capture the variability away from the means. The formulas and explanations for these advanced metrics covered in the remaining plots can be found at the following links (<https://www.nbastuffer.com/analytics101/four-factors/>) and (<https://www.nbastuffer.com/analytics-101/team-evaluation-metrics/>). Formulas of some of the advanced metrics used are also included at the bottom of this report.



As intuition suggests, Lakers as a team on average grabbed less offensive and defensive rebounds during losses than in wins. Also, they have a lower average effective field goal percentage. During losses, Lakers performed worse while their opponents played better. The opponents had a lower turnover rate, higher free throw rate, and higher effective shooting percentage when they won. Lakers average shooting percentages, especially from 3pt range (29% vs 38%), were lower in losses than in wins. In contrast, the opponents had higher average field goal and 3 pt field goal shooting percentages in wins. Below are additional efficiency metrics that help explain both offense and defense play a role in Lakers wins versus losses. Under wins, Lakers have on average a +10.6 net efficiency (117.5 - 106.9) while they have on average -11.9 net efficiency (107 - 118.9) during losses.



Lastly, we will compare average individual player performance across wins and losses. I filtered out Lakers players who did not average double-digits in points and immediately, we can see Lakers had more balanced scoring during wins. Seven players averaged at least 10 points under wins while only 4 players averaged at least 10 points during losses. LeBron James, Brandon Ingram, and Kyle Kuzma produce similar statistics in wins and losses. The difference between winning and losing is often on the performance of role players. Elite players are typically consistent so if role players also perform well, then teams are more likely to win games and vice versa.

Player	GP	PPG	APG	RPG	SPG	BPG
LeBron James	28	27.7	8.1	8.9	1.4	0.5
Kyle Kuzma	33	18.2	2.2	5.7	0.6	0.5
Brandon Ingram	25	15.5	3.6	4.8	0.7	0.6
Alex Caruso	7	13.1	3.9	2.7	1.3	0.1
Kentavious Caldwell-Pope	37	13.0	1.3	3.1	0.9	0.1
Reggie Bullock	5	12.6	1.0	3.6	1.2	0.2

Player	GP	PPG	APG	RPG	SPG	BPG
LeBron James	27	25.6	8.4	8.0	1.2	0.7
Brandon Ingram	27	19.7	2.4	5.4	0.4	0.6
Kyle Kuzma	37	18.1	2.9	5.3	0.5	0.3
JaVale McGee	40	11.3	0.5	7.5	0.5	1.8

\* Per Game Averages when Lakers Lost

Player	GP	PPG	APG	RPG	SPG	BPG
JaVale McGee	35	12.0	0.9	7.6	0.7	2.1

\* Per Game Averages when Lakers Won

If given more time and resources, I would like to explore more in depth analysis involving player tracking data. With play-by-play data, we are able to capture team and individual player aggregated stat trends but we cannot dive into player locations and movements. We could hypothesize that Lakers offensive movement may be more stagnant or opponents are contesting more shots that cause Lakers to miss often in losses. We may find specific on-court reasons that explain Lakers results in terms of in-game strategy such as offensive and defensive execution.

## Formulas

$$Possessions = (0.96 \times FGA) + TO + (0.44 \times FTA) - OREB$$

$$eFG\% = \frac{FGM + 0.5 \times 3PM}{FGA}$$

$$TO\% = \frac{TO}{FGA + 0.44 * FTA + TO}$$

$$OREB\% = \frac{OREB}{OREB + Opponents DREB}$$

$$FT\% = \frac{FTA}{FGA}$$

$$Offensive Efficiency = 100 \times \frac{Pts Scored}{Possessions}$$

$$Defensive Efficiency = 100 \times \frac{Pts Allowed}{Possessions}$$

$$Net Efficiency = (Offensive Efficiency) - (Defensive Efficiency)$$