SIMULATION OF 1992-93 NHL SEASON

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SEASON OVERVIEW

- Pens hot after 2 Back to Back Stanley cups
  - Finished with an excellent record of 56-21-7
  - Mario Lemieux diagnosed with Hodgkins Lymphoma
    - On pace to challenge Wayne Gretzky’s famous records, but had season abruptly ended
    - Despite missing about 28% of the regular season, he finished with the most points in the league
    - Won Art Ross and Hart Trophies
  - Pens favored for “three-peat”
- Highest scoring regular season in NHL History
  - 7,311 goals scored over 1,008 games for an average of 7.25 goals a game
  - Only 68 shutouts recorded during regular season

SEASON FORMAT

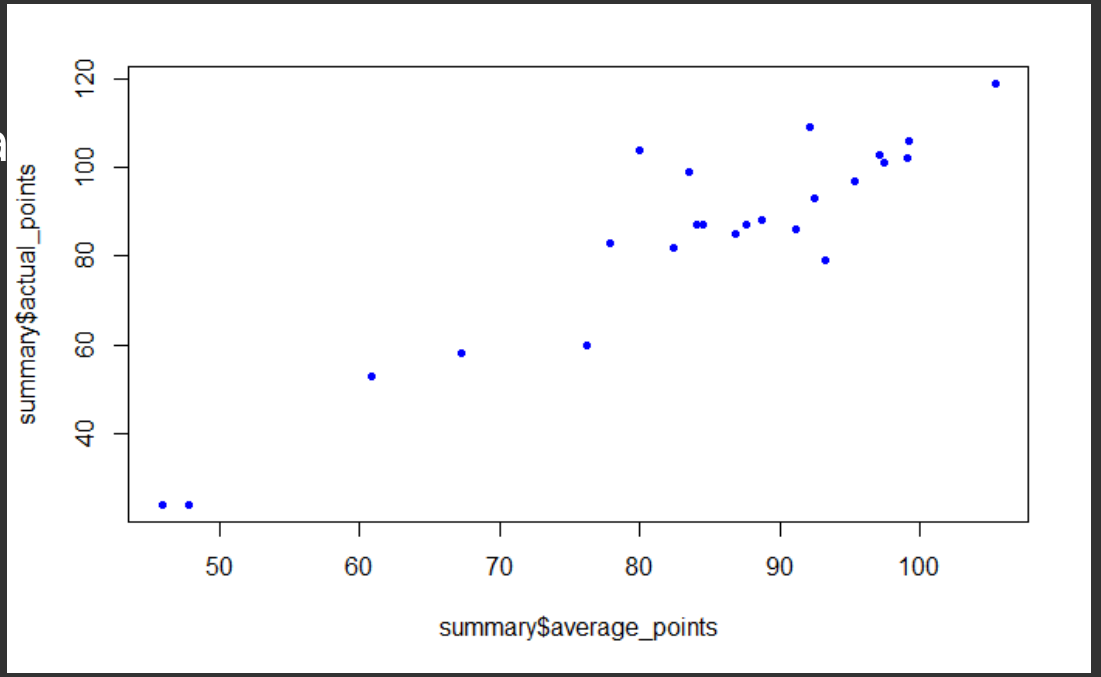
- Regular Season Format
  - Each team played a total of 84 games
    - Total of 1,008 games in a regular season
  - 2 Conferences
    - Prince of Wales (East) and Clarence Campbell (West)
  - 4 Divisions – 6 teams each
    - Adams, Patrick, Norris, Smythe
- Playoff Format
  - Top 4 teams per division make it
    - 8 teams per conference
  - No wildcard teams/games – No bye rounds
  - Play games respective to division 1v4, 2v3
    - Teams are seeded solely from division, no conference standings

SIMULATED REGULAR SEASON RESULTS

team <chr>	division <chr>	average_points <dbl>	actual_points <int>	residuals <dbl>
Montreal Canadiens	Adams	99.1184	102	2.8816
Boston Bruins	Adams	92.1534	109	16.8466
Buffalo Sabres	Adams	91.1689	86	-5.1689
Quebec Nordiques	Adams	79.9187	104	24.0813
Hartford Whalers	Adams	67.2751	58	-9.2751
Ottawa Senators	Adams	45.9129	24	-21.9129
Chicago Blackhawks	Norris	99.1773	106	6.8227
Detroit Red Wings	Norris	97.0850	103	5.9150
St. Louis Blues	Norris	86.8470	85	-1.8470
Toronto Maple Leafs	Norris	83.4578	99	15.5422
Minnesota North Stars	Norris	82.4435	82	-0.4435
Tampa Bay Lightning	Norris	60.8480	53	-7.8480
Pittsburgh Penguins	Patrick	105.3438	119	13.6562
New York Rangers	Patrick	93.2736	79	-14.2736
Washington Capitals	Patrick	92.4812	93	0.5188
New Jersey Devils	Patrick	87.6033	87	-0.6033
New York Islanders	Patrick	84.0580	87	2.9420
Philadelphia Flyers	Patrick	77.8242	83	5.1758
Vancouver Canucks	Smythe	97.4730	101	3.5270
Calgary Flames	Smythe	95.3296	97	1.6704
Los Angeles Kings	Smythe	88.7248	88	-0.7248
Winnipeg Jets	Smythe	84.4510	87	2.5490
Edmonton Oilers	Smythe	76.1747	60	-16.1747
San Jose Sharks	Smythe	47.8568	24	-23.8568

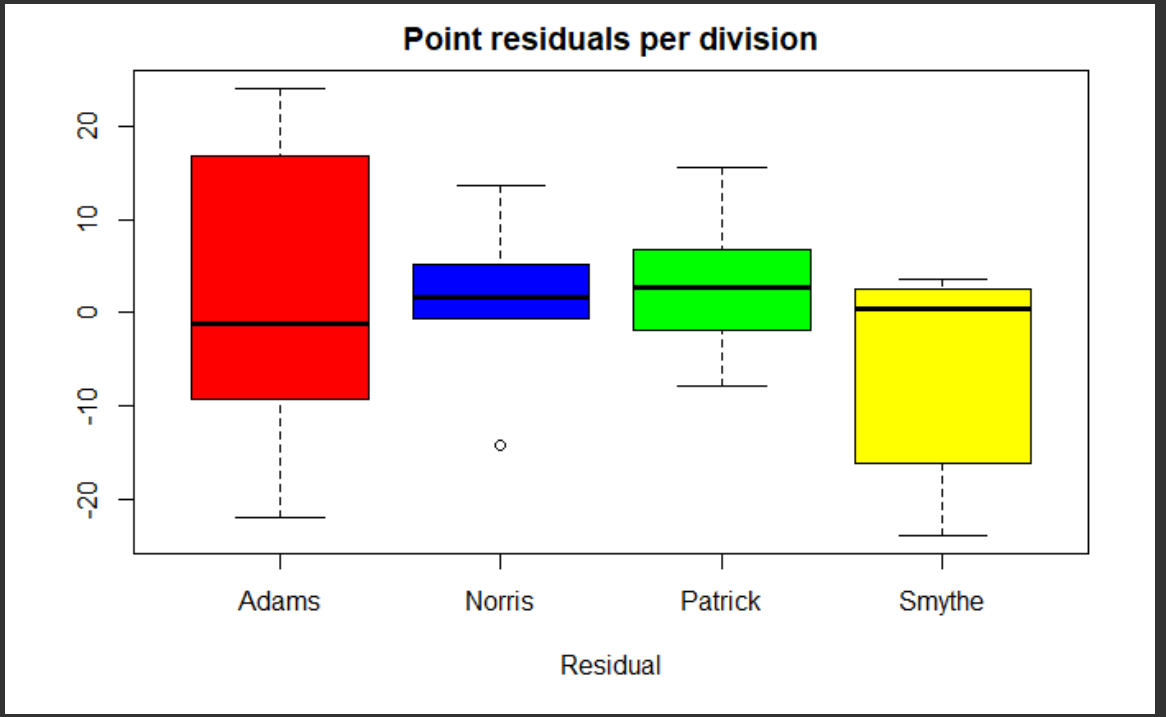
COMPARISON OF SIMULATED AND ACTUAL REGULAR SEASONS

- Simulated points vs Actual points
  - Cor = .927
  - Strong correlation
  - Two bottom left teams with low sim and actua
    - Senators and Sharks
      - Both expansion teams
  - Top right team
    - Penguins
      - Highest sim points with 105
      - Highest actual points with 119



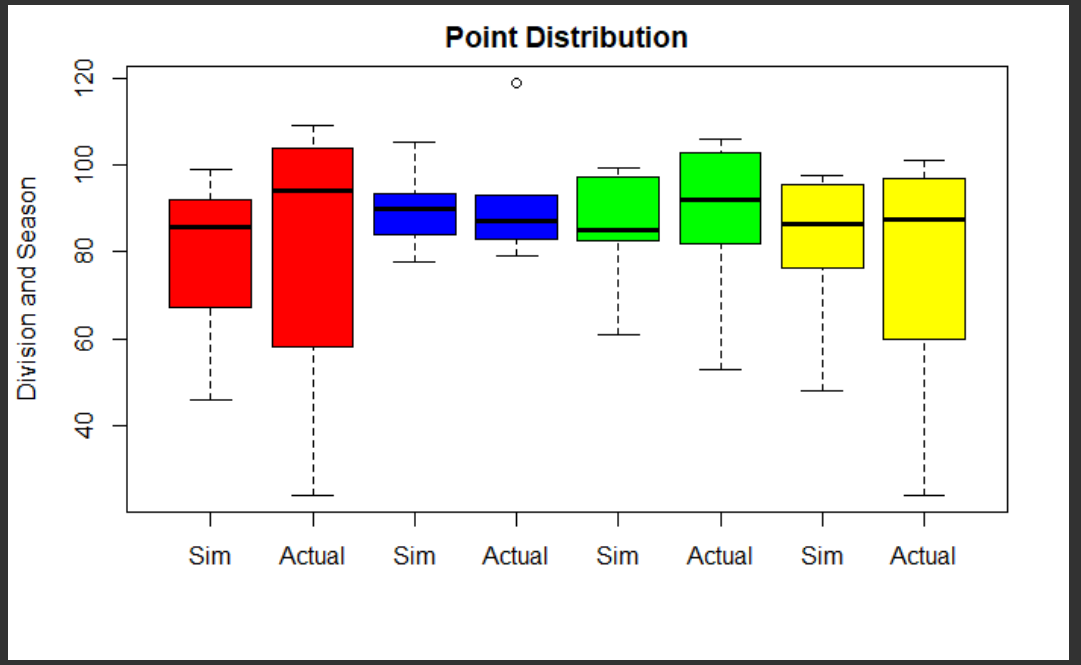
COMPARISON OF SIMULATED AND ACTUAL REGULAR SEASONS

- Point Residuals per Game
  - Adams division had the highest volatility with the lowest mean
  - Norris had small range with an outlier
    - Outlier – Tampa Bay Lightning
      - First year in league
      - Simulation struggles with expansion teams
  - Patrick most normal distribution out of the four
  - Smythe had a higher mean than Adams but more teams fell below expectations



COMPARISON OF SIMULATED AND ACTUAL REGULAR SEASONS

- Point Distributions
  - The simulation did a decent job of predicting the season
    - There was a lot of underachieving teams during the actual season shown by the tails of the box plots
    - The means are very close for the Sim vs Actual
    - Outlier in the Patrick Division for the actual season
      - Penguins – very large positive residual of 13.65



REGULAR SEASON RESULTS

- Pens, Blackhawks, Canadiens, Canucks, Red Wings, Flames, Capitals, Bruins, Sabres, Kings all fell within expectations
  - In simulation, each of these teams made playoffs >90% of the time
- Pens, Blackhawks, Canucks won their respective divisions the most
  - Canadiens won their division the most in simulation
    - Actually, finished third
    - The Bruins, who actually won it, only won in the simulation about 20% of the time

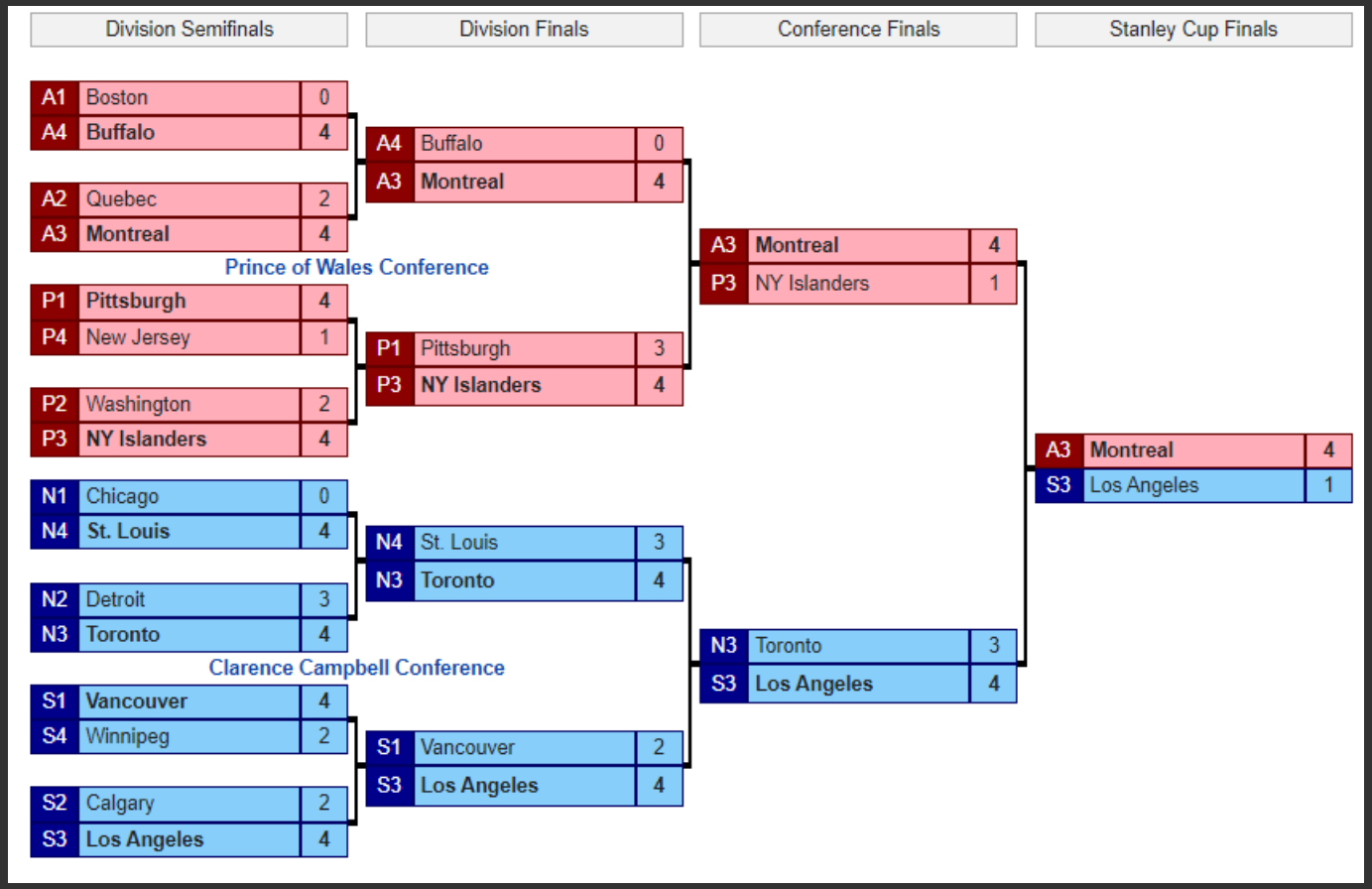
REGULAR SEASON RESULTS

- New York Rangers
  - Did not make playoffs at all in real life – finished bottom place in Patrick Division
  - Simulation had them making playoffs 87% of the time and winning the division 10% of the time
- Quebec Nordiques
  - Finished second in the Adams division
  - Simulation had them making playoffs 88% of the time and winning the division ~1%
- Since 16 teams made the playoffs and 3 teams were brand new, there isn’t much surprise in which teams actually made the playoffs
  - The biggest upset had to be the Rangers
  - Second place went to the Nordiques with them turning around their previously awful season

SIMULATED PLAYOFF RESULTS

team	division	playoffs	division_titles	conference_championships	championships	pre_season_elo	end_season_elo	elo_difference
<chr>	<chr>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>
Boston Bruins	Adams	9949	2023	2039	1137	1514.132	1584.845	70.712802
Montreal Canadiens	Adams	9996	6148	1051	477	1536.085	1549.960	13.874173
Buffalo Sabres	Adams	9904	1719	439	155	1504.632	1519.953	15.320329
Quebec Nordiques	Adams	8824	110	318	122	1423.990	1517.460	93.470537
Ottawa Senators	Adams	3	0	0	0	1406.667	1280.952	-125.714785
Hartford Whalers	Adams	1324	0	2	0	1473.218	1417.020	-56.197336
Detroit Red Wings	Norris	9780	3830	2961	1510	1532.676	1592.553	59.877438
Chicago Blackhawks	Norris	9900	5278	2443	1136	1550.520	1579.688	29.168352
Toronto Maple Leafs	Norris	6473	216	372	118	1462.881	1529.386	66.504609
St. Louis Blues	Norris	7989	509	417	111	1522.265	1519.378	-2.887903
Minnesota North Stars	Norris	5802	167	63	5	1484.594	1463.587	-21.006769
Tampa Bay Lightning	Norris	56	0	0	0	1406.667	1366.954	-39.712608
Pittsburgh Penguins	Patrick	9945	7624	4541	3219	1561.327	1631.693	70.365603
Washington Capitals	Patrick	8564	895	867	421	1539.122	1557.503	18.380812
New York Islanders	Patrick	4546	126	227	91	1495.179	1529.873	34.693724
New Jersey Devils	Patrick	6547	313	248	82	1525.655	1518.944	-6.711282
New York Rangers	Patrick	8718	1025	228	65	1559.345	1506.244	-53.100987
Philadelphia Flyers	Patrick	1680	17	40	11	1494.556	1506.886	12.329842
Vancouver Canucks	Smythe	9910	4880	1767	718	1517.465	1552.421	34.955135
Calgary Flames	Smythe	9824	3571	1188	412	1514.964	1532.132	17.168016
Los Angeles Kings	Smythe	9160	1097	464	120	1517.717	1503.118	-14.599511
Winnipeg Jets	Smythe	8001	412	319	90	1494.799	1500.094	5.294414
Edmonton Oilers	Smythe	3103	40	6	0	1511.364	1402.420	-108.943379
San Jose Sharks	Smythe	2	0	0	0	1395.606	1282.364	-113.241226

ACTUAL PLAYOFF BRACKET



COMPARISON OF SIMULATED AND ACTUAL PLAYOFFS

- Numerous upsets in actual playoffs
  - Third ranked team in each division made it to their respective conference finals
    - Notable upsets include:
      - Canadiens beating Boston
      - Islanders beating Pens
  - Blackhawks, winner of Norris division, swept in first round
  - Detroit beat by Leafs first round
  - Canadiens 11 win streak going to win the Stanley Cup
  - Pens – largest cup favorite – eliminated in second round
- Blackhawks, Bruins, Canucks, Flames
  - All favored to make a deep Stanley cup run
    - Eliminated either first or second round

COMPARISON OF SIMULATED AND ACTUAL PLAYOFFS

- Simulation predictions for actual conference champions
  - Canadiens - 10.5%
  - Kings – 4.6%
    - Low percentages considering 3rd ranked team in each division
- Pens odds of winning Stanley cup ~32%
  - Canadiens – 4.7%
  - Simulation favored Pens and Red Wings to make the championship game
    - Both teams had the highest Elos
    - Red Wings eliminated first round, Pens second

ANALYZING INDIVIDUAL TEAMS

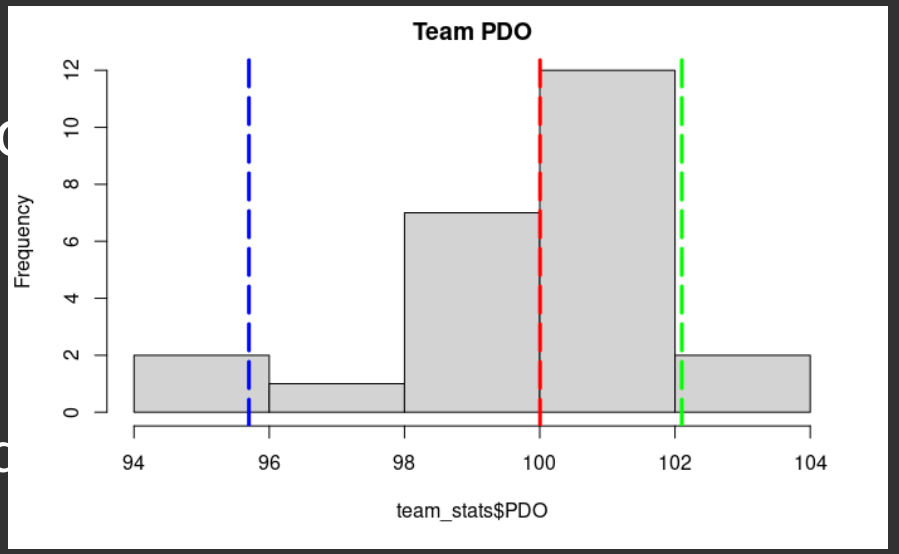
- Close to expectations – Washington Capitals
- Underachiever – San Jose Sharks
- Overachiever – Quebec Nordiques

team <chr>	division <chr>	playoffs <dbl>	division_titles <dbl>	conference_championships <dbl>	championships <dbl>	pre_season_elo <dbl>	end_season_elo <dbl>	elo_difference <dbl>	simulation_points <dbl>	actual_points <int>
Washington Capitals	Patrick	8564	895	867	421	1539.122	1557.503	18.38081	92.4812	93
San Jose Sharks	Smythe	2	0	0	0	1395.606	1282.364	-113.24123	47.8568	24
Quebec Nordiques	Adams	8824	110	318	122	1423.990	1517.460	93.47054	79.9187	104

- Caps - Nearly identical simulation and actual points
  - Simulation had them making playoffs most of the time with not a very deep run predicted. Eliminated first round
- Sharks – Performed well under expectations
  - Had an actual 11 win season
  - Interestingly, there were 2 seasons where the sharks made the playoffs despite having the worst record
- Nordiques – Performed well above expectations
  - Had about 24 more points than simulation expected

RELEVANT STATISTICS

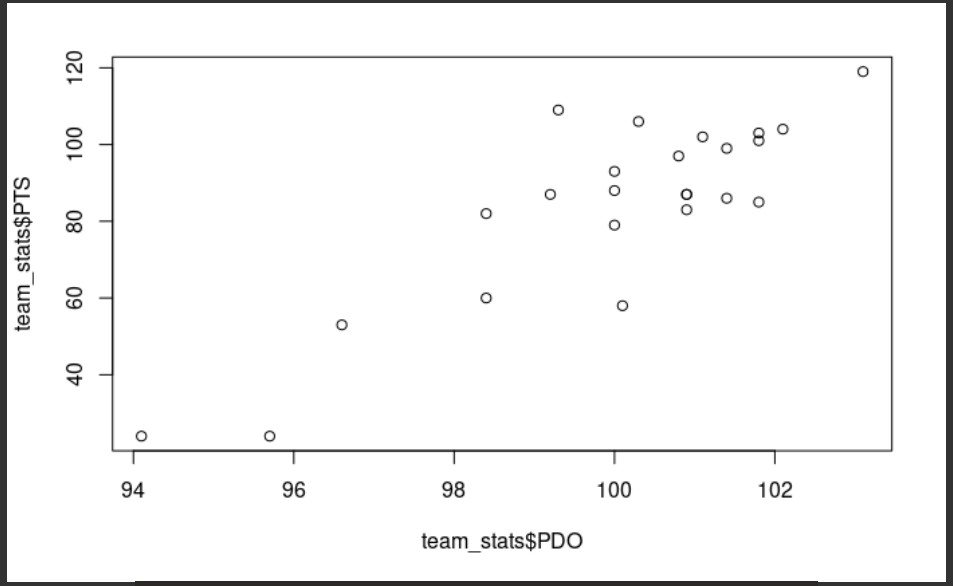
- Team PDO, measuring luck of a team
  - League Average PDO = 100, confirms statistic
  - Capitals – PDO = 100
    - Team right on average confirming our statement
  - Sharks – PDO = 95.7
    - Second lowest in league, encountered extremely bad
      - Detrimentally affected their season
  - Nordiques – PDO = 102.1
    - Second highest in league, encountered extremely good luck
      - Helped contribute to their overachieving season



- Histogram of PDO Legend
  - Red = Average(100)
  - Blue = Sharks(95.7)
  - Green = Nordiques(102.1)

RELEVANT STATISTICS

- PDO vs Actual Points
  - How much does luck impact winning?
  - Answer: A lot!!
    - Correlation between PDO and points ~ .858
    - Teams in the bottom left with extremely bad luck ex. Senators and Sharks had the lowest wins and points in the league
    - The Pens, in the top right, had the highest puck luck and gained the highest amount of points
    - Running a regression on PDO predicting PTS
      - PDO significant




```
lm(formula = PTS ~ PDO, data = team_stats)

Residuals:
    Min      1Q  Median      3Q     Max
-26.946  -6.425   0.258   5.650  31.954

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) -903.636    126.218  -7.159 3.54e-07 ***
PDO            9.876      1.262   7.827 8.48e-08 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 12.82 on 22 degrees of freedom
Multiple R-squared:  0.7357,    Adjusted R-squared:  0.7237
F-statistic: 61.25 on 1 and 22 DF,  p-value: 8.479e-08
```

CONCLUSION

- By far, one of the most interesting seasons in NHL history
  - The shootout nature of games resulted in variable PDO values
  - The quantity of upsets in actual playoffs shattered simulation
    - Canadiens who won the cup had a 4.7% chance
  - Favorites eliminated left and right despite having a substantial ELO difference in opponent
  - The poor expansion teams suffered tremendously – far more than the simulation could ever predict
- Would be interesting to take a further look at player statistics this season due to the high nature of scoring
  - So many players broke the 100-point barrier that it wasn’t even that impressive