



Fantasy Barclays Premier League Weekly Starting Lineup Optimization

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Introduction


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Club	Pld	Pts
Man City	14	29
Leicester	14	29
Man Utd	14	28
Arsenal	14	27
Spurs	14	25
Liverpool	14	23
Crystal Palace	14	22
West Ham	14	22
Everton	14	21
Southampton	14	20
Watford	14	19
Stoke	14	19
West Brom	14	18
Chelsea	14	15
Swansea	14	14
Norwich	14	13
Sunderland	14	12
Bournemouth	14	10
Newcastle	14	10
Aston Villa	14	5

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Fantasy Sports have risen in popularity over the recent years, since the Internet boom. Fantasy Sport is a virtual game environment where participants assemble their own virtual teams constituting real players of a professional sport. These teams compete based on the statistical performance of those players' players in actual games. The player performance is converted into points that are compiled and totaled according to a roster selected by each fantasy team's manager.

The Fantasy Sports Trade Association (FSTA) estimates 56.8 Million people over age 12 have played Fantasy Sport in the US & Canada in 2015.

Fantasy Barclays Premier League is the leading fantasy sports provider in the UK with 3 million users.

- Winning 1st Prize of the Fantasy league offers £25,000, and other monthly & quarterly prizes.
- A fantasy team is pitted against 3 Million other fantasy teams for the top spot, and individual leagues can also be created.

Data Collection

The official website of the Fantasy Barclays Premier League at fantasy.premierleague.com has been used to collect the data.

The data used for this project is for the initial 12 games played out of 38 in the current 2015-16 season.

Objective Overview

The primary objective of this project is to come up with a model formulation, allowing Fantasy Barclays Premier League users to choose the optimum mix of starting lineup players. Through the use of Excel Solver and Simplex Linear Programming, we are optimizing the drafting of players for maximizing the weekly total score of a team on the fantasy BPL.

Problem Statement

With over 700 players across 20 different Barclays Premier League teams, choosing the right mix of 15 players to give you the most points, while not stretching the budget constraints is a difficult task. Similar in its approach to different Fantasy leagues for NHL, NBA and MLB, Fantasy Barclays Premier League is one of the most popular Fantasy Soccer games online with 3 million registered users.

Choosing the perfect match of players for a fantasy team which would result in maximum weekly points, while adhering to the league rules is a stiff competition. Optimization techniques using Simplex Linear Programming would make it easier for users to optimize their best set of starting lineup players on the Fantasy league.

Formulation Approach

The process of optimization of Fantasy Barclays Premier League starting lineup begins with the understanding of the rules of the game. A Fantasy League game has certain sets of rules and conditions to which all of the users must abide to.

Given the total number of available fantasy league players at 700, the maximum budget of £100 Million and much more rules as such, formulating the problem at hand efficiently begins with a clear understanding of the constraints of such a Fantasy sport.

Variables & Constraints:

- Variables:
 - 700 Fantasy players, across 20 different teams.
- Constraints (For Selected the Top 15 Players):
 - Total budget must not exceed £100 million.
 - There must be a total of 15 players.
 - There must be exactly 2 Goalkeepers
 - There must be exactly 5 Defenders
 - There must be exactly 5 Midfielders
 - There must be exactly 2 Strikers
 - Not more than 3 players must be selected from a single team.
- Constraints (For Selected the Starting 11 Players):
 - There must be a total of 11 players.
 - There must be exactly 1 Goalkeeper
 - There must be at least 3 Defenders
 - A maximum of 5 Midfielders can be chosen
 - There must be at least 1 Forward

Project Workflow

Using the official website of the Barclays Fantasy Premier League and the subsequent data for the 2015-16 season (12 out of 38 games played until now), data is extracted and organized to be easily read and analyzed using Excel Solver.

A major part of the problem lies in the number of constraints and variables which are approximated to be around 30+ and 700 respectively. Such analysis of large datasets is prohibited in Excel Solver, which limits the number of variables to 200 at any given time. This makes us to organize our data by the different player positions (Goalkeeper, Defender, Midfielder, and Striker) into different Excel spreadsheets.

The analysis of the different positions are done individually and the top players from each of these categories will be called upon into the final Excel spreadsheet for analysis. The player index rating would be used to calculate the efficiency of players, who would return the maximum points in any game week.

The player index we are using for analysis of player efficiency would be calculated by finding the cost per point, from the player's accrued points until now and his cost in the market. The efficient set of players would be determined from their cost per point, with the player costing the least per point considered into the starting lineup. Below is a flow diagram of the process we're implementing to obtain the optimized set of fantasy premier league starting lineup.

The entire set of data (700 Players, their accumulated points and Total cost in the market) is extracted from the official website.



Given the limitations of Solver, the most efficient players from each of the four player positions would be extracted into a single Excel spreadsheet of 200 players for the final analysis.



The constraints, variables and objective function are obtained from the official fantasy gameplay rules, which are listed below:

1. The total budget, which must not exceed £100 Million.
2. Squad Size: Total of 15 players (including substitutes)
 - 2 Goalkeepers
 - 5 Defenders
 - 5 Midfielders
 - 3 Strikers
3. Not more than 3 players to be selected from a single team.
4. From the total of 15 players, the starting lineup must contain exactly 1 Goalkeeper, at least 3 Defenders, and at least 1 forward at any given point of time.



Using these above constraints and the player index rating, the weekly optimal starting lineup of 11 players will be extracted.

Methodology

Player Performance Index (PPI)

The Player Performance Index is determined by calculating the cost per point, from the points accrued until now and the player's cost in the market.

The player with the least cost per point are considered into the starting lineup.

Goalkeepers

10 Top Goalkeepers out of 61 total Goalkeepers have been selected. These players have been selected after ordering them according to their cost per point in the fantasy league. The top 10 Goalkeepers giving the most fantasy points at a minimum cost are considered for further analysis.

Player Name	Team	Cost (in £ million)	Cost (in £)	Total Fantasy Points	Player Performance Index		In
Butland	STK	4.7	4700000	65	72307.69231		1
Gomes	WAT	4.7	4700000	62	75806.45161		1
Myhill	WBA	4.8	4800000	60	80000		1
Howard	EVE	5.1	5100000	54	94444.44444		1
Cech	ARS	5.6	5600000	59	94915.25424		1
Hart	MCI	5.7	5700000	53	107547.1698		1
Lloris	TOT	5.1	5100000	46	110869.5652		1
Stekelenburg	SOU	5	5000000	43	116279.0698		1
Mignolet	LIV	5	5000000	40	125000		1
de Gea	MUN	5.6	5600000	44	127272.7273		1
Guzan	AVL	4.4	4400000	34	129411.7647		1
Schmeichel	LEI	4.5	4500000	34	132352.9412		1

Defenders

90 Top Defenders out of 181 total Defenders have been selected. These players have been selected after ordering them according to their cost per point in the fantasy league. The top 90 Defenders giving the most fantasy points at a minimum cost are considered for further analysis.

Player Name	Team	Cost (in £ million)	Cost (in £)	Total Fantasy Points	Player Performance Index	In
Brown	SUN	4.3	4300000	-1	-4300000	1
Dann	CRY	5.2	5200000	55	94545.45455	1
Sagna	MCI	5.5	5500000	58	94827.58621	1
Kolarov	MCI	6.2	6200000	64	96875	1
Johnson	STK	5	5000000	50	100000	1
Smalling	MUN	6.7	6700000	66	101515.1515	1
Nyom	WAT	4.6	4600000	44	104545.4545	1
Monreal	ARS	5.9	5900000	56	105357.1429	1
Dawson	WBA	5.1	5100000	48	106250	1
Pieters	STK	4.9	4900000	46	106521.7391	1
Alderweireld	TOT	5.4	5400000	50	108000	1
Bellerín	ARS	5.9	5900000	54	109259.2593	1
Cathcart	WAT	4.6	4600000	42	109523.8095	1
Kompany	MCI	6.4	6400000	58	110344.8276	1
Koscielny	ARS	6	6000000	54	111111.1111	1

Midfielders

70 Top Defenders out of 181 total Defenders have been selected. These players have been selected after ordering them according to their cost per point in the fantasy league. The top 70 Defenders giving the most fantasy points at a minimum cost are considered for further analysis.

Player Name	Team	Cost (in £ million)	Cost (in £)	Total Fantasy Points	Player Performance Index	In
Brown	SUN	4.3	4300000	-1	-4300000	1
Dann	CRY	5.2	5200000	55	94545.45455	1
Sagna	MCI	5.5	5500000	58	94827.58621	1
Kolarov	MCI	6.2	6200000	64	96875	1
Johnson	STK	5	5000000	50	100000	1
Smalling	MUN	6.7	6700000	66	101515.1515	1
Nyom	WAT	4.6	4600000	44	104545.4545	1
Monreal	ARS	5.9	5900000	56	105357.1429	1
Dawson	WBA	5.1	5100000	48	106250	1
Pieters	STK	4.9	4900000	46	106521.7391	1
Alderweireld	TOT	5.4	5400000	50	108000	1
Bellerín	ARS	5.9	5900000	54	109259.2593	1
Cathcart	WAT	4.6	4600000	42	109523.8095	1
Kompany	MCI	6.4	6400000	58	110344.8276	1
Koscielny	ARS	6	6000000	54	111111.1111	1

Forwards

30 Top Forwards out of 93 total Forwards have been selected. These players have been selected after ordering them according to their cost per point in the fantasy league. The top 30 Forwards giving the most fantasy points at a minimum cost are considered for further analysis.

Player Name	Team	Cost (in £ million)	Cost (in £)	Total Fantasy Points	Player Performance Index	In
Ighalo	WAT	5.6	5600000	74	75675.67568	1
Vardy	LEI	7.4	7400000	93	79569.89247	1
Koné	EVE	4.9	4900000	58	84482.75862	1
Lukaku	EVE	8.8	8800000	86	102325.5814	1
Deeney	WAT	5.1	5100000	48	106250	1
Ayoze	NEW	5.1	5100000	43	118604.6512	1
Fletcher	SUN	5	5000000	39	128205.1282	1
Pellè	SOU	8.5	8500000	66	128787.8788	1
Wilson	BOU	5.4	5400000	38	142105.2632	1
Bojan	STK	5.1	5100000	34	150000	1
Jerome	NOR	4.7	4700000	30	156666.6667	1
Kane	TOT	9.4	9400000	59	159322.0339	1

Selecting the Top 15 Players

Position	Player Name	Team	Cost (in £ million)	Cost (in £)	Total Fantasy Points	Player Performance Index	In
G	Butland	STK	4.7	4700000	65	72307.69231	1
G	Gomes	WAT	4.7	4700000	62	75806.45161	1
G	Myhill	WBA	4.8	4800000	60	80000	0
G	Howard	EVE	5.1	5100000	54	94444.44444	0
G	Cech	ARS	5.6	5600000	59	94915.25424	0
G	Hart	MCI	5.7	5700000	53	107547.1698	0
G	Lloris	TOT	5.1	5100000	46	110869.5652	0
G	Stekelenburg	SOU	5	5000000	43	116279.0698	0
G	Mignolet	LIV	5	5000000	40	125000	0
G	de Gea	MUN	5.6	5600000	44	127272.7273	0
D	Dann	CRY	5.2	5200000	55	94545.45455	0
D	Sagna	MCI	5.5	5500000	58	94827.58621	1
D	Kolarov	MCI	6.2	6200000	64	96875	1
D	Johnson	STK	5	5000000	50	100000	0
D	Smalling	MUN	6.7	6700000	66	101515.1515	1
D	Nyom	WAT	4.6	4600000	44	104545.4545	0
D	Monreal	ARS	5.9	5900000	56	105357.1429	1
D	Dawson	WBA	5.1	5100000	48	106250	0
D	Pieters	STK	4.9	4900000	46	106521.7391	0
D	Alderweireld	TOT	5.4	5400000	50	108000	0
D	Bellerín	ARS	5.9	5900000	54	109259.2593	0
D	Cathcart	WAT	4.6	4600000	42	109523.8095	0
D	Kompany	MCI	6.4	6400000	58	110344.8276	1

The selected Top 200 players out of the entire roster of 700 players are now tabulated in a single Excel spreadsheet as shown before. All of these players are initialized to 0, indicating that they are not selected into the final team. Using Excel's built-in IF conditions, all of these players are initiated to '0' or 'Blank' according to their positions as Goalkeeper, Defender, Midfielder or Forward.

TOTAL BUDGET	100000000	99500000
SQUAD SIZE	15	15
TOTAL POINTS		1078
G	2	2
D	5	5
M	5	5
F	3	3
ARS	3	1
AVL	3	0
BOU	3	0
CHE	3	0
CRY	3	0
EVE	3	2
LEI	3	2
LIV	3	0
MCI	3	3
MUN	3	1
NEW	3	0
NOR	3	0
SOU	3	0
TOT	3	0
STK	3	1
SUN	3	0
SWA	3	1
WAT	3	2
WBA	3	0
WHU	3	1

Using the aforementioned procedure, all of the fantasy team's constraints are defined as shown above. Here, the maximum number of players from each team, the total budget, total number of players, and number of players for each position have been defined for further analysis using Excel Solver.

Using Excel Solver

The screenshot shows the 'Solver Parameters' dialog box in Excel. The 'Set Objective:' field is set to '\$Q\$2'. The 'To:' section has three radio buttons: 'Max' (selected), 'Min', and 'Value Of:'. The 'By Changing Variable Cells:' field is set to '\$I\$2:\$I\$16'. The 'Subject to the Constraints:' list contains the following constraints: '\$I\$2:\$I\$16 = binary', '\$Q\$1 = \$P\$1', '\$Q\$4 = \$P\$4', '\$Q\$5 >= \$P\$5', '\$Q\$6 <= \$P\$6', and '\$Q\$7 >= \$P\$7'. To the right of the list are buttons for 'Add', 'Change', 'Delete', 'Reset All', and 'Load/Save'. Below the constraints list is a checked checkbox labeled 'Make Unconstrained Variables Non-Negative'. The 'Select a Solving Method:' dropdown is set to 'Simplex LP'. Below this is a text box explaining the solving methods: 'Select the GRG Nonlinear engine for Solver Problems that are smooth nonlinear. Select the LP Simplex engine for linear Solver Problems, and select the Evolutionary engine for Solver problems that are non-smooth.' At the bottom are buttons for 'Help', 'Solve', and 'Close'.

As seen from the above screenshot of the process using Excel Solver, the Objective function is set to the Total Points cell, which has to be maximized.

The changing variable cells are set as the Initialization column, whose values vary only between 0's and 1's as being set as 'Binary' while defining the constraints.

Other constraints included in Excel Solver are the constraints related to the number of players in each position and other constraints as described earlier.

Results

Player Name	Team	Cost (in £ million)	Cost (in £)	Total Fantasy Points	Player Performance Index	In	G	D	M	F		SQUAD SIZE	11	11
Butland	STK	4.7	4700000	65	72307.69231		1	1				TOTAL POINTS		830
Gomes	WAT	4.7	4700000	62	75806.45161		0	0						
Sagna	MCI	5.5	5500000	58	94827.58621		0		0			G	1	1
Kolarov	MCI	6.2	6200000	64	96875		1		1			D	3	3
Smalling	MUN	6.7	6700000	66	101515.1515		1		1			M	5	4
Monreal	ARS	5.9	5900000	56	105357.1429		0		0			F	1	3
Kompany	MCI	6.4	6400000	58	110344.8276		1		1					
Mahrez	LEI	6.7	6700000	96	69791.66667		1			1				
Barkley	EVE	6.9	6900000	72	95833.33333		0			0				
Ayew	SWA	7.1	7100000	74	95945.94595		1			1				
Payet	WHU	7.9	7900000	74	106756.7568		1			1				
Özil	ARS	9	9000000	80	112500		1			1				
Ighalo	WAT	5.6	5600000	74	75675.67568		1				1			
Vardy	LEI	7.4	7400000	93	79569.89247		1				1			
Lukaku	EVE	8.8	8800000	86	102325.5814		1				1			

After the Top 15 players out of the 200 shortlisted players are selected, a starting team of 11 players has to be chosen as previously mentioned in the project workflow section. These 15 players are again initialized to 0's and a final lineup of 11 players are selected, whose results are summarized above.

The final starting lineup is summarized below:

Starting 11 Players:

Butland (G)	Stoke City
Kolarov (D)	Manchester City
Smalling (D)	Manchester United
Kompany (D)	Manchester City
Mahrez (M)	Leicester City
Ayew (M)	Swansea City
Payet (M)	West Ham Utd
Özil (M)	Arsenal FC
Ighalo (F)	Watford FC
Vardy (F)	Leicester City
Lukaku (F)	Everton FC

Formation:

- 1 Goalkeeper
- 3 Defenders
- 4 Midfielders
- 3 Forwards

Total Points Earned:

- 830 Points

Total Budget Used:

- £99.5 Million

Conclusion

The final optimized Starting 11 players of the Fantasy Barclays Premier league successfully met all of the league rules.

The fantasy starting lineup optimization has to be done on a weekly basis, eliminating any injured or suspended players.

Team Members and Duties

Kislav Kumar Rai – Data collection, extraction and preparation for analysis.

Adwait Deshpande – Formulation of problem constraints, variables and objectives.

Vidit Brahmkar – Formulation of problem constraints, variables and objectives.

Nikhil Soman – Final Data optimization using Excel Solver.