Wasted Potential: Optimizing team rosters by maximizing star ratings

Paranundrox (@Paranundrox#6397)[*]
[*]Society for Internet Blaseball Research

ABSTRACT *Analysis of ILB team lineups following the Season 3 election indicates that there are players not being used to their full potential, and that optimization of team rosters by changing between the assignment of pitchers to batters and vice versa is possible by examination of all possible roster configurations.*

KEYWORDS
Star Ratings
Roster
Optimization

TEAM LINEUPS

A blaseball team roster consists of nine players assigned to the lineup[1], responsible for batting and fielding duties, and five players assigned to the rotation[2], responsible for pitching on a rotating schedule, with any given pitcher making an appearance in one out of every five games (Figure 1).

Figure 1 The Canada Moist Talkers Roster (as of the Season 3 election)

STAR RATING

Each player in blaseball has a Star Rating in all four categories of: Defense, Baserunning, Pitching and Batting. Prior to the results of the Season 3 election, only one value was displayed for each player, with Pitchers displaying their Pitching Rating and Batters displaying their Batting Rating.

Following the Season 3 election, player Star Ratings for Defense, Baserunning[3,4], Pitching and Batting were displayed for all players, revealing that some players have higher Star Ratings in categories that do not match their assignment on the roster. It is important to note that a player's Star Rating is not a guarantee as to their level of effectiveness. SIBR analysis of player performance statistics indicates that some individual attributes may be more important for player performance than the Stars Rating weighting system accounts for, but Star Rating does generally correlate with strong performances Shibboh (2020).

PITCHING VS. BATTING

A key component of establishing an optimized roster is defining a process by which a roster can be said to be optimized or not. There are 2,002 combinations of player assignments to the rotation and lineup (ignoring the ordering of players within their categorization), so each team is likely to be faced with multiple options that are not strictly better than each other. For example, it is likely that one specific roster will give a team its maximum possible Pitching Star Rating, while shifting around players could give them a different roster with the team's maximum Batting Star rating. Comparing the appearance of individual batters and pitchers on a team over the season gives some basis for valuing the maximization of one parameter over the other.

While a Batter makes an average of 4.2 plate appearances per game in a 99 game season, the average Pitcher in a 99 game season

[1] Henceforth, batters
[2] Henceforth, pitchers

[3] Baserunning Star Rating appears to display a duplicate of the Defense rating
[4] The commissioner is doing a great job

will pitch $19 - 20$ games and face 37.8 batters per game pitched Corvimae and lilserf (2020). As a result, a pitcher faces from $1.73 - 1.83$ times as many batters as a given batter has plate appearances[5], giving a rough conversion of:

$$\text{pitching star} \approx 1.81 \cdot \text{batting star}$$

or:

$$\text{batting star} \approx 0.55 \cdot \text{pitching star}$$

Meaning that when comparing two potential optimized rosters, trading stars one for one is not necessarily ideal. Additionally, the magnitude of the Star Rating in question should be taken into consideration; adding one Batting Star to a 30 star lineup at the cost of one Pitching Star might be a bad deal, but for a team with a poor lineup and a stronger rotation, it may be more reasonable.

■ **Table 1** Team Roster Combinations

	Possible Rosters	Unique Roster Star Ratings	Pareto Optimal Rosters
Breath Mints	2,002	123	5
Crabs	2,002	268	4
Dalé	2,002	283	7
Firefighters	2,002	251	3
Flowers	2,002	369	9
Fridays	2,002	230	5
Garages	2,002	153	9
Jazz Hands	2,002	275	8
Lovers	2,002	179	3
Magic	2,002	245	5
Millennials	2,002	227	5
Moist Talkers	2,002	334	10
Pies	2,002	292	8
Shoe Thieves	2,002	302	8
Spies	2,002	274	7
Steaks	2,002	276	9
Sunbeams	2,002	254	7
Tacos	2,002	213	5
Tigers	2,002	345	3
Wild Wings	2,002	131	3

METHODOLOGY

In order to generate all possible roster Star Rating combinations, all 2,002 distinct pitching rotations and batting lineups were generated for each team, and the unique Star Rating pairings were extracted (Table 1). The resulting sets of extracted rosters were graphed independently for each team (Figures 2a - 2t), which gave a visual representation of the rosters that are *Pareto Optimal*,

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[5] Assuming the player or batter in question is neither incinerated or replacing an incinerated player

meaning that those rosters are arranged such that increasing the Batting Star Rating or Pitching Star Rating would require shifting players around in a fashion that would result in a loss of stars in the other category. For example, if there are three rosters of 12 Pitching Stars and 25 Batting Stars, 13 Pitching Stars and 25 Batting Stars or 12 Pitching Stars and 26 Batting Stars, the first roster can be directly improved by moving to the second or the third, but choosing between the second and third options means selecting whether you value the extra Batting or Pitching star higher.

RESULTS

In selecting the optimal lineup, the nature of Pareto Optimal combinations means that the value of trade-offs in selection must be taken into account. The valuation of Pitching and Batting Stars above suggests that any movement from one Pareto Optimal roster to another that involves trading one Batting Star for about half a Pitching Star is worthwhile, and generates the Roster values found in Table 2, while simply selecting the the options with maximum number of combined stars results in the roster combinations displayed in Table 3.

■ **Table 2** Rosters Selected by Weighted Trade-off

	Pitching Stars	Pitching Change	Batting Stars	Batting Change
Breath Mints	10	+3	21	+1
Crabs	16	+6.5	22	-1
Dalé	15.5	+3.5	16.5	+0
Firefighters	17.5	+4	28.5	+0.5
Flowers	14.5	+5	22	+2
Fridays*	13.5	+5	20.5	+3
Garages	11.5	+1.5	22	+0.5
Jazz Hands	11	+2.5	24	-0.5
Lovers*	14.5	+4.5	27.5	+4
Magic*	12.5	+2.5	20	-0.5
Millennials	16.5	+4	27.5	+4
Moist Talkers*	16.5	+3.5	19	+1
Pies*	13.5	+6	26.5	+4.5
Shoe Thieves*	15	+9	24.5	-1.5
Spies	15	+8.5	22.5	+4
Steaks*	17	+6.5	21	-0.5
Sunbeams	13	+6	18	-1.5
Tacos	8.5	+3	17	+1.5
Tigers	17.5	+1	28	-1.5
Wild Wings	15.5	+4	19.5	+1

*Also appear in the Maximum Total Stars table

| | Roster Stars | | |
	Pitching	Batting	Star Change
Spies	14.5	23.5	+12.5
Pies	**13.5**	**26.5**	+10.5
Lovers	**14.5**	**27.5**	+8.5
Flowers	11	16.5	+8
Fridays	13	21	+8
	13.5	**20.5**	
Millennials	16	28.5	+8
Shoe Thieves	**15**	**24.5**	+7.5
Crabs	14.5	25	+7
Steaks	15	23	+6
	17	**21**	
Firefighters	16.5	30	+5.5
	17	29.5	
Breath Mints	8	24	+5
Wild Wings	14.5	20.5	+5
	15.5	**19.5**	
Moist Talkers	14.5	21	+4.5
	15	20.5	
	16.5	**19**	
Sunbeams	10.5	20.5	+4.5
	11.5	19.5	
	13	**18**	
Tacos	**8.5**	**17**	+4.5
Dalé	14.5	18	+4
	15	17.5	
Garages	9.5	25	+3
Jazz Hands	8	28	+3
	9	27	
	9.5	26.5	
	10.5	25.5	
Magic	12	20.5	+2
	12.5	**20**	
Tigers	14.5	31.5	+0
	16.5	29.5	

Bold values also appear in the Weighted Trade-off table

ANALYSIS

The charts in Figures 2a - 2d display the current team roster, marked in blue, relative to all unique combinations of Pitching Star Rating and Batting Star Rating. The green points represent Pareto Optimal lineups, but every point above the dashed horizontal line or right of the dashed vertical line represents a lineup that is better than the current roster in at least one of the categories.

As such, it's important to note the difference between teams with low Star Ratings and low Star Rating potential when optimized, like the Tacos, and teams with higher current Star Ratings and few options for improvement, like the Tigers.

While the shape and locations of teams' charts vary, they can be broadly classified into four shapes (Table 4), which can be used to predict the makeup of players on the team. The "Round" teams have a spread of players who are fairly close to each other in Star Ratings, and are "balanced" in that individual players have Batting Star Ratings and Pitching Star Ratings of nearly equal values. The "Flat" teams have players with similar Batting Star Ratings, and a range of Pitching Star Ratings (notably, the Wild Wings have six 2.5 star batters and six 2 star batters), meaning that shuffling players around is likely to affect pitching fairly dramatically without often impacting team batting. "Ascending" teams have higher variance players, who are independently either high in Pitching Stars or high in Batting Stars, such that picking the best pitchers to pitch also means putting the best batters into the lineup. Finally, "Descending" teams have the opposite issue - their best batters tend to also be their best pitchers, so optimizing for Batting Stars or Pitching Stars necessarily means making larger trade-offs in stars than Round, Flat or Ascending teams.

■ **Table 4** Teams by Shape of Unique Rosters Charts

Unique Rosters Shape	Teams
Round	Breath Mints, Jazz Hands, Magic, Fridays, Tacos
Flat	Crabs, Dalé, Shoe Thieves, Spies, Wild Wings
Ascending	Firefighters, Lovers, Millennials, Tigers
Descending	Flowers, Garages, Moist Talkers, Pies, Steaks, Sunbeams

The four shapes can also be condensed into two categories based on their leading edge: both Flat and Ascending teams have few Pareto Optimal lineups, represented by the green dots on the rosters charts, while Round and Descending teams present a much larger surface along their leading edge, meaning that there is much more room for minor trade-offs and tweaking of lineups to slightly improve either Batting or Pitching Star Ratings.

Additionally, while the shape of a team's possible rosters chart determines how many Pareto Optimal lineups it has, it says nothing about the actual benefit to the team that optimization would bring. Table 3 shows the maximum number of stars that a team stands to gain from optimization, and the top two teams are the Spies and Pies, who are "Flat" and "Descending" shapes, respectively, while the Tigers, an "Ascending" team, are already at their maximum total star count. Ultimately, optimization under either

method proposed in this paper would result in a dramatic increase in the Pitching Star Rating of the average pitcher, and smaller increases for average Batting Star Rating (Table 5).

■ **Table 5** League Average Player Star Ratings

	Pitcher Stars	Batter Stars
Current Star Ratings	1.94	2.39
Weighted Trade-off Star Ratings	2.85	2.49
Maximum Total Star Ratings*	2.65	2.64

*For teams with multiple Maximum Total Stars rosters, the average of each teams rosters was used to calculate the league average

FUTURE WORK

While duplicate results indicate unique rotations and lineups, optimization for baserunning and defense Star Ratings were not taken into account, partially due to the lack of accurate information. Additionally, this paper only looks at unique rosters and not their frequency of appearance, and a future project could examine potential outcomes of roster randomization on teams, as opposed to the comparison of optimal selected rosters presented here.

ACKNOWLEDGEMENTS

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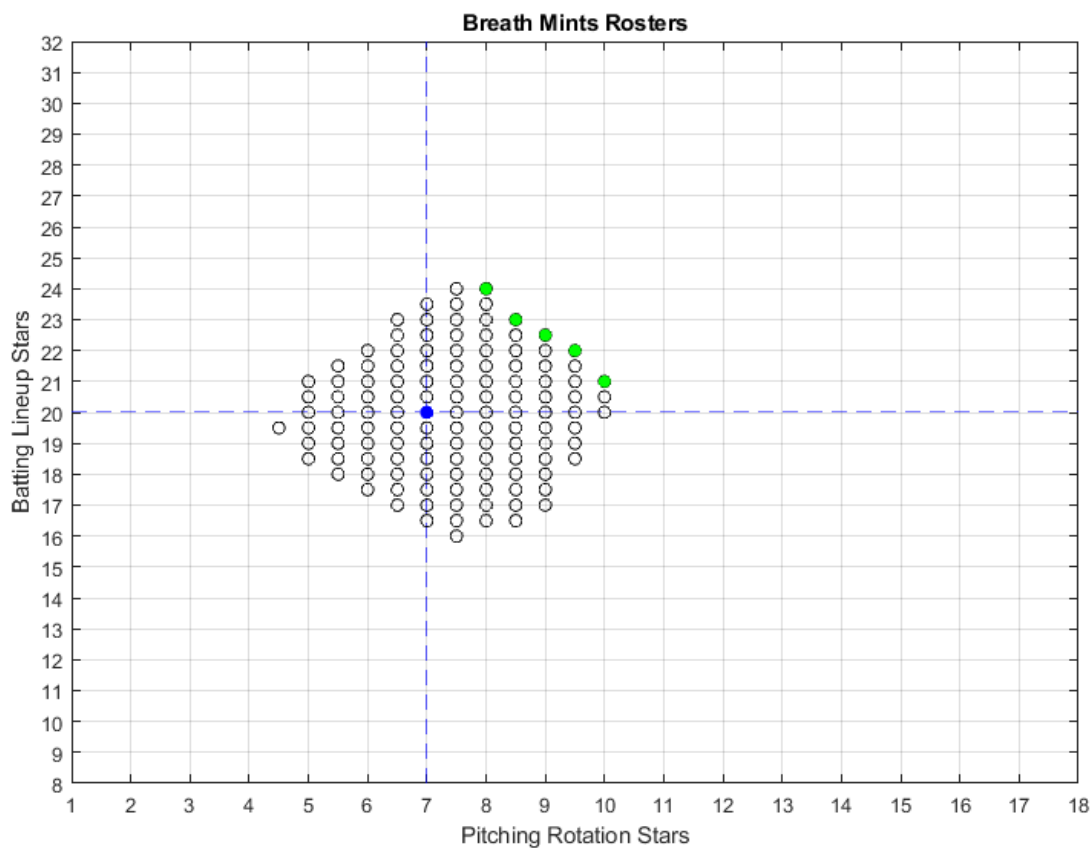
(a) All unique Breath Mints rosters
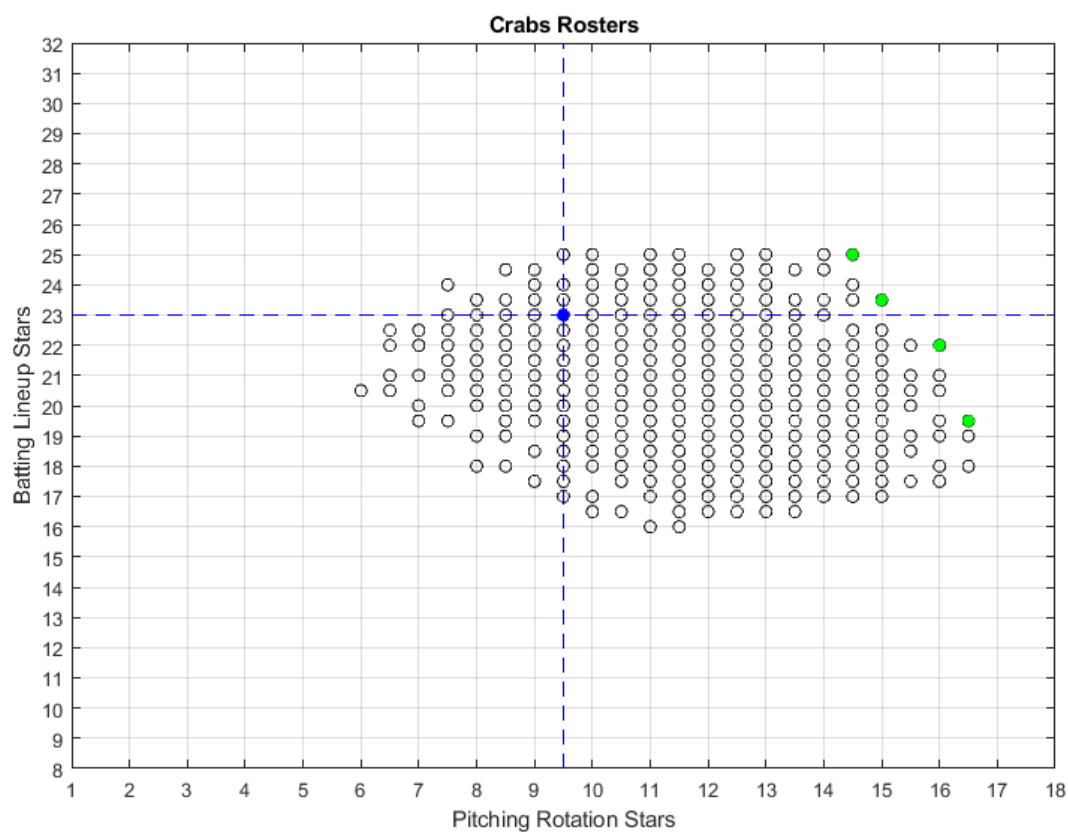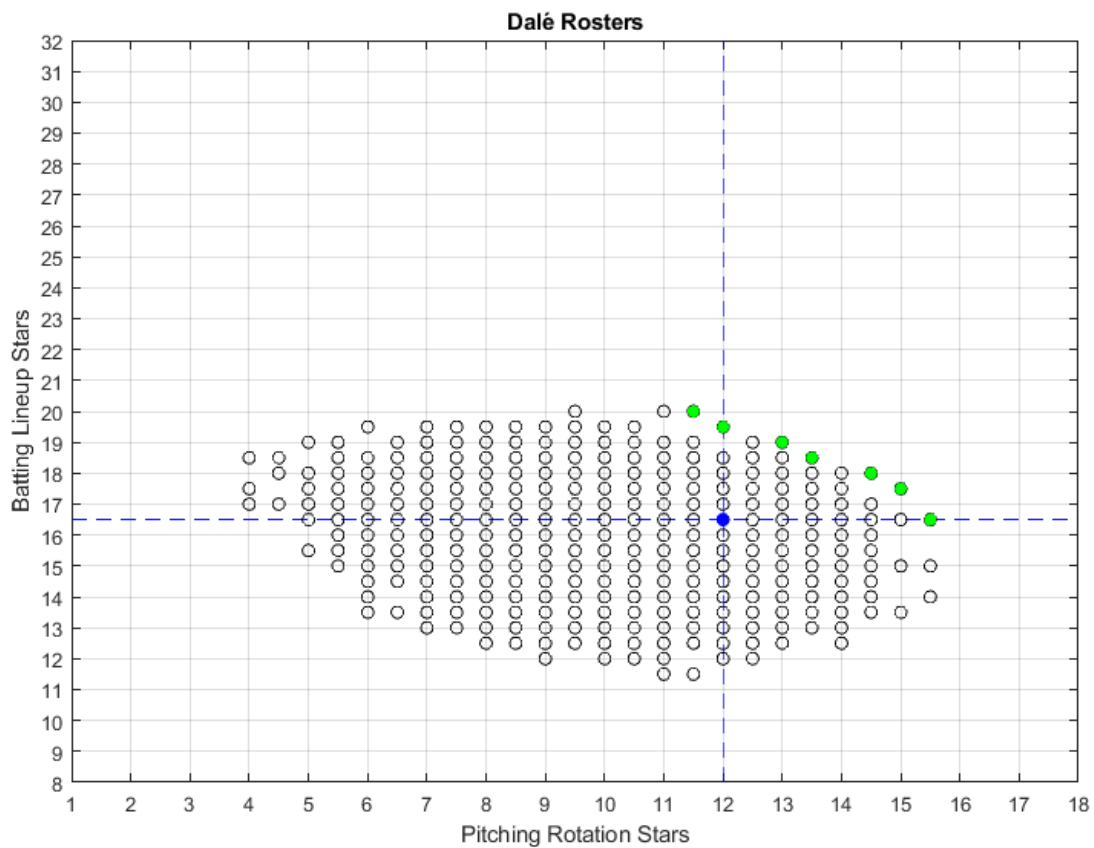
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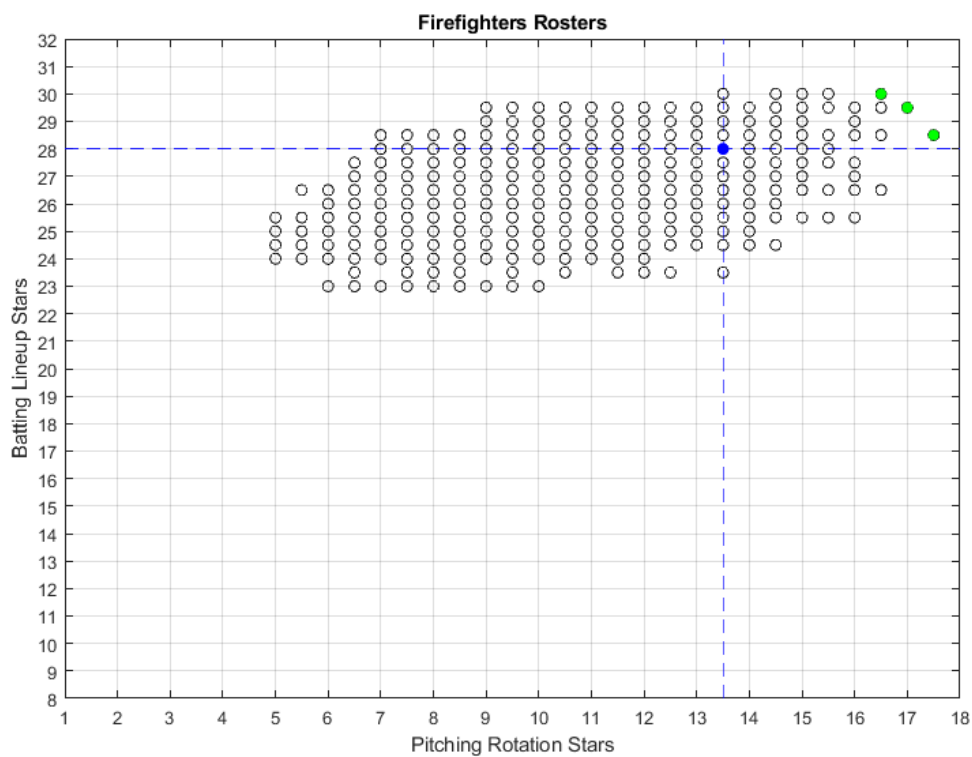
(d) All unique Firefighters rosters
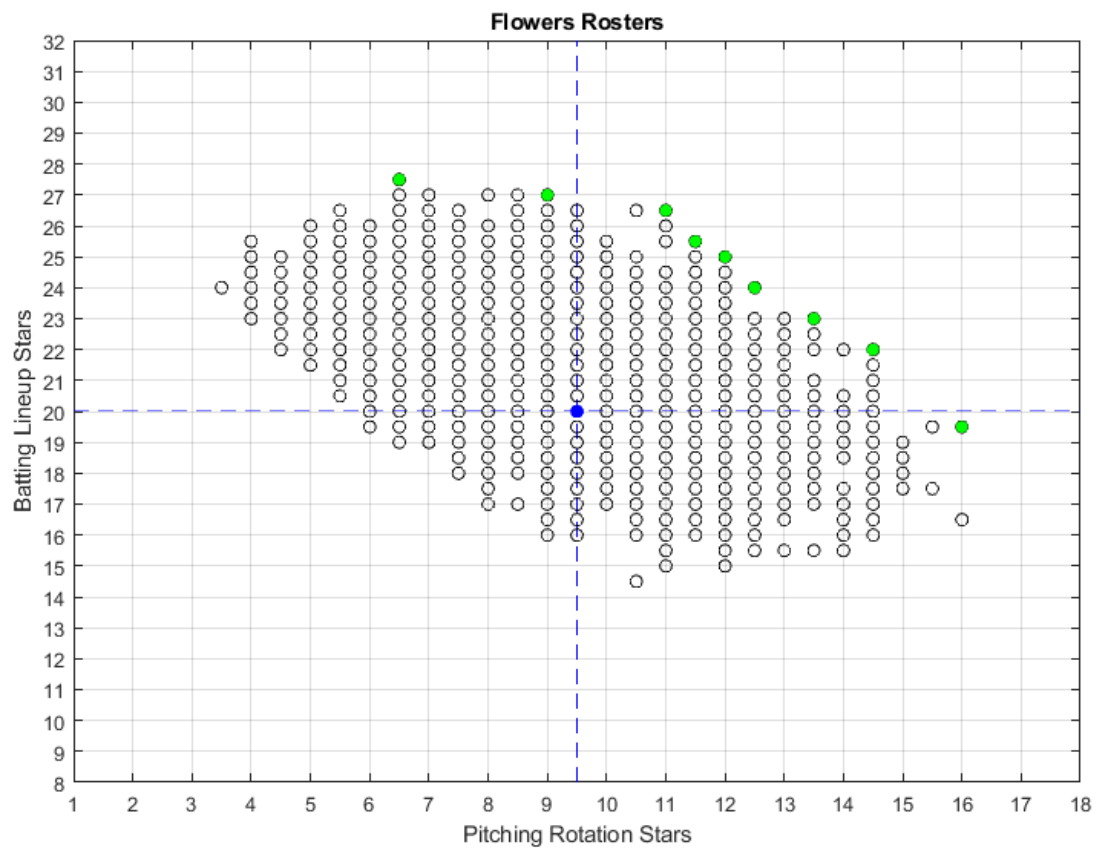
(e) All unique Flowers rosters
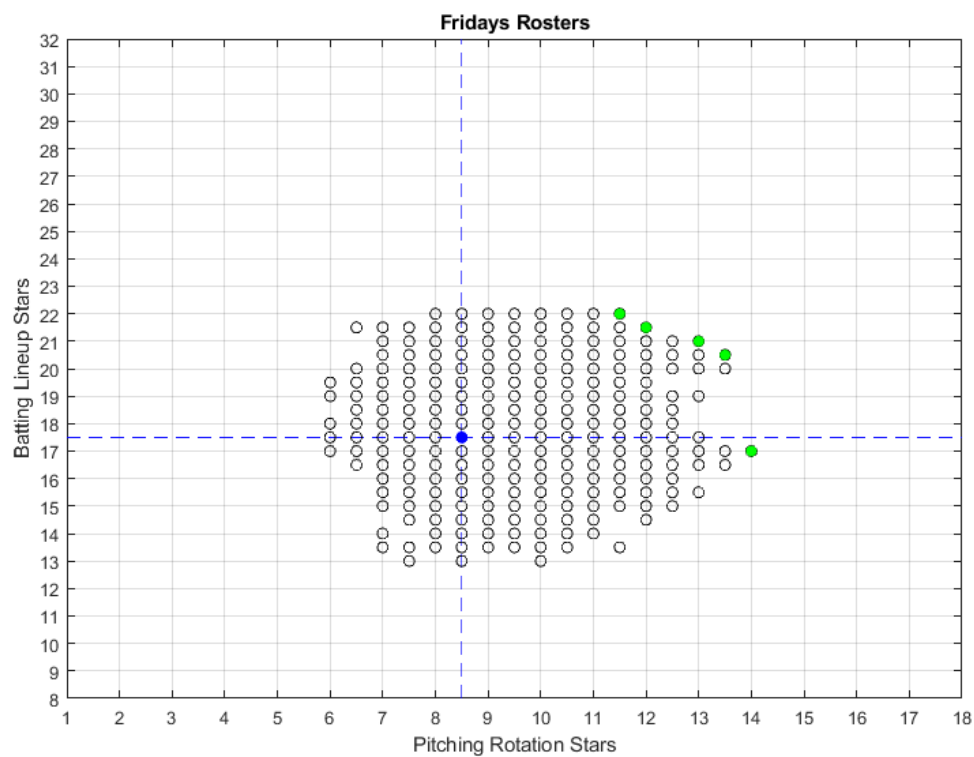
(f) All unique Fridays rosters

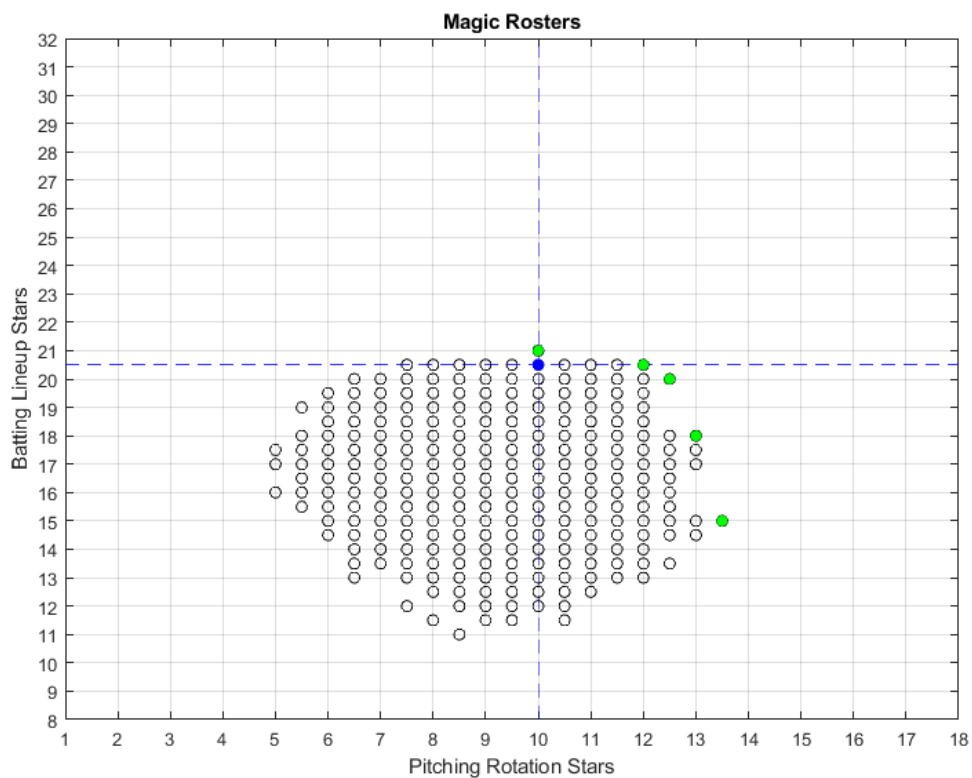SOCIETY FOR INTERNET BLASEBALL RESEARCH
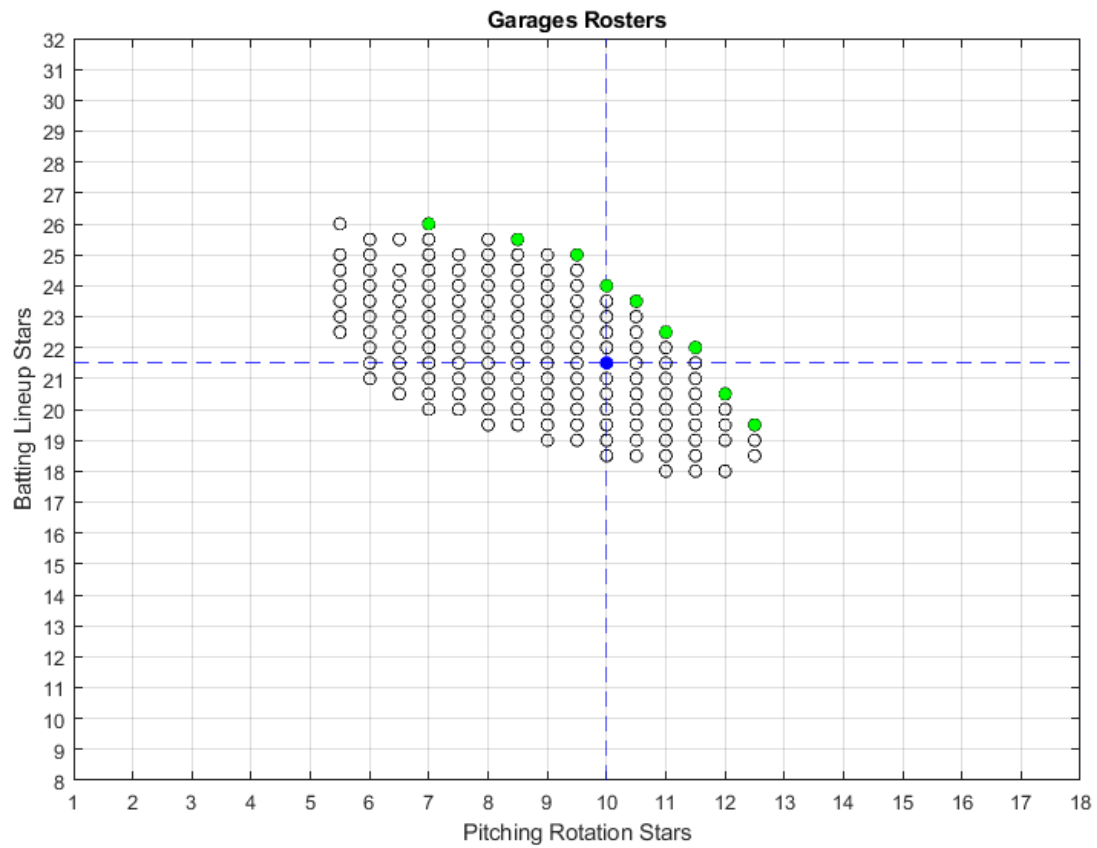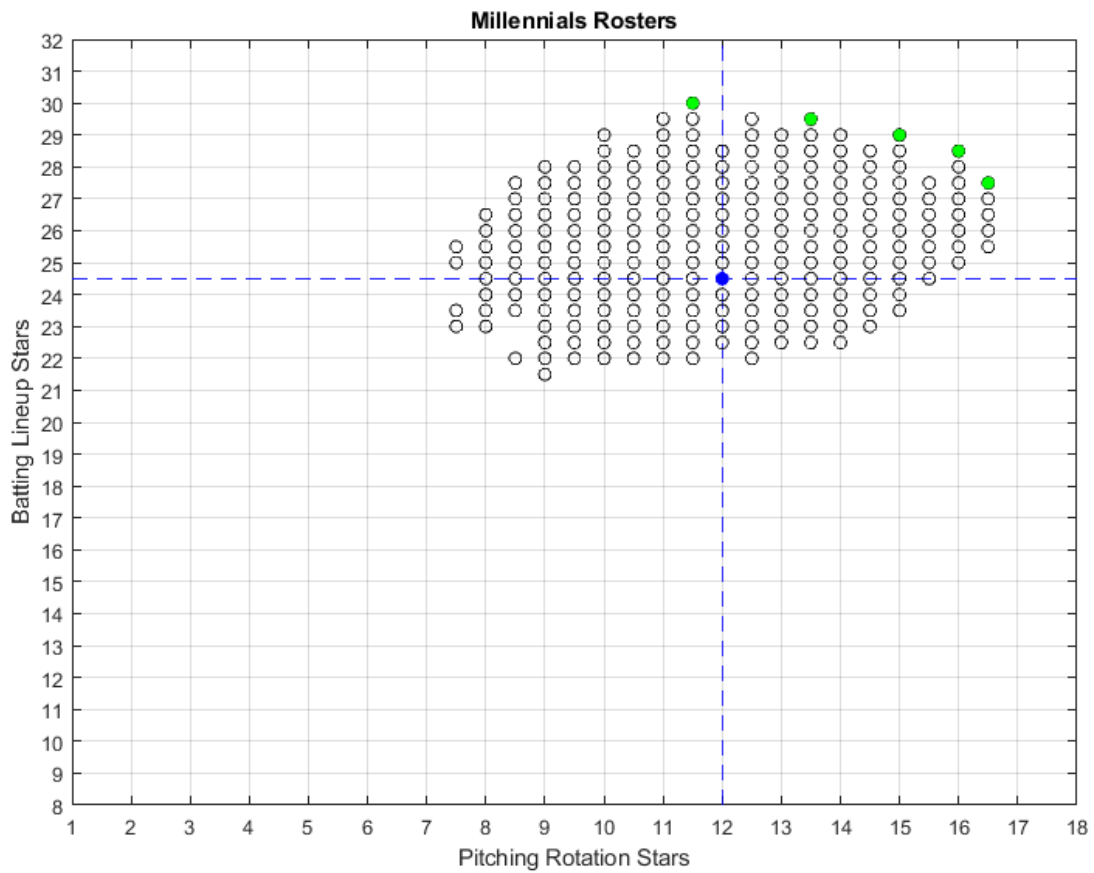
(g) All unique Garages rosters
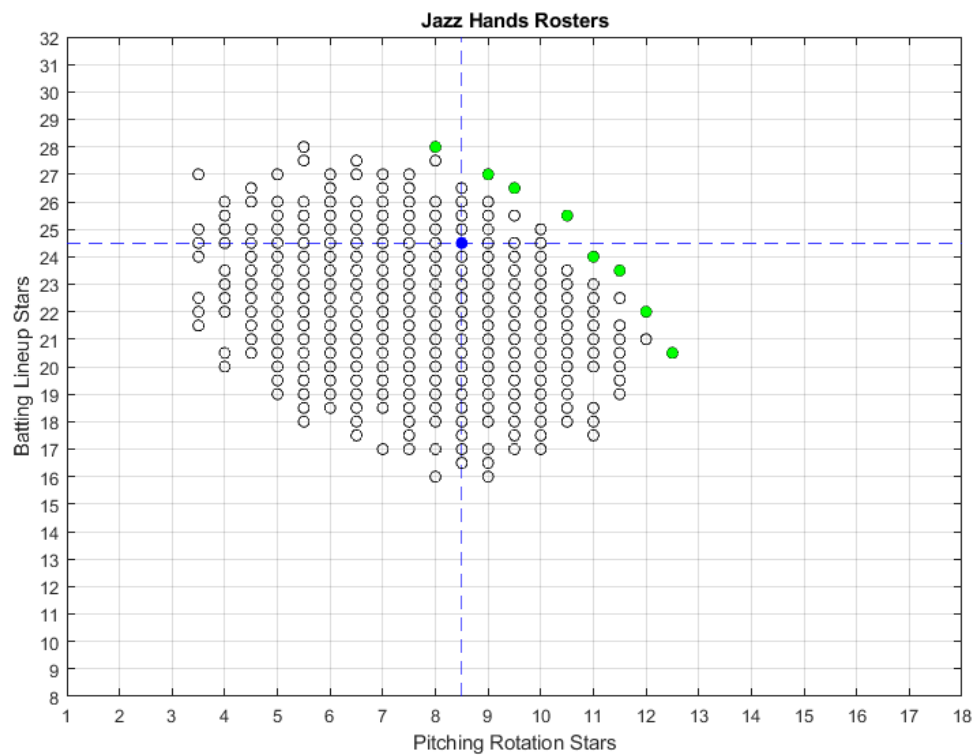
(h) All unique Jazz Hands rosters
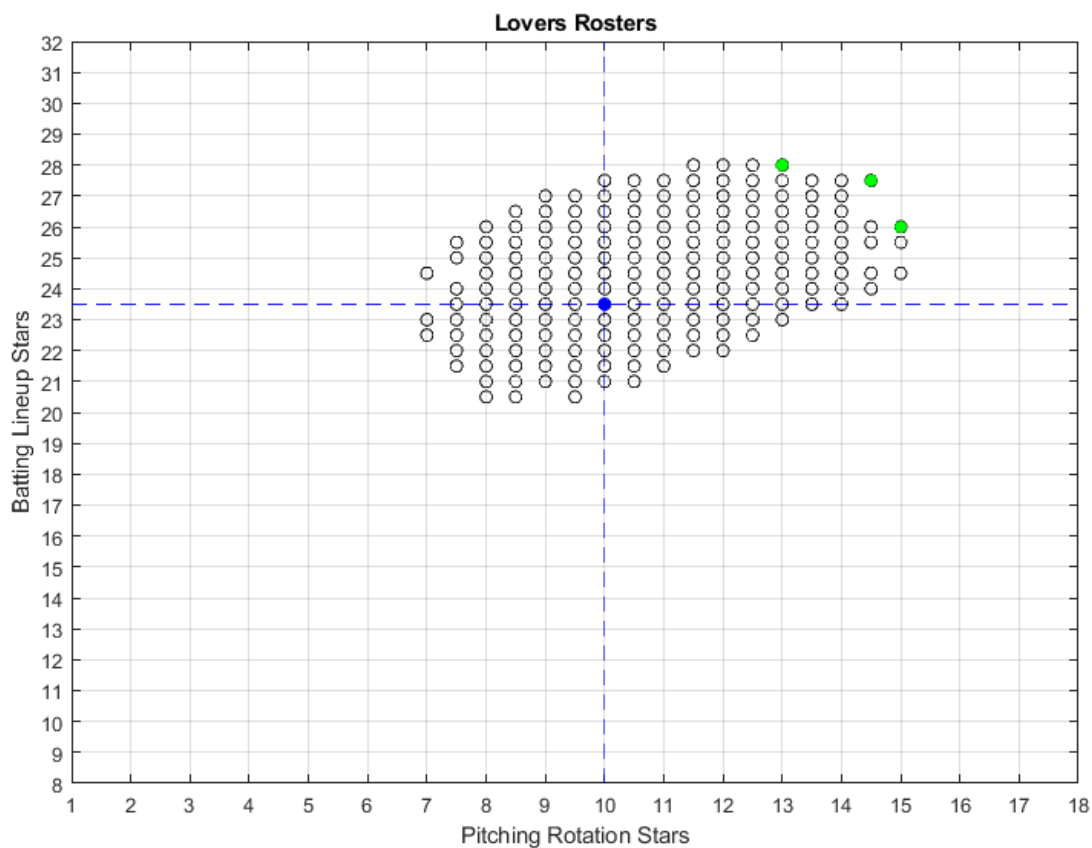
(i) All unique Lovers rosters

(j) All unique Magic rosters

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(k) All unique Millennials rosters
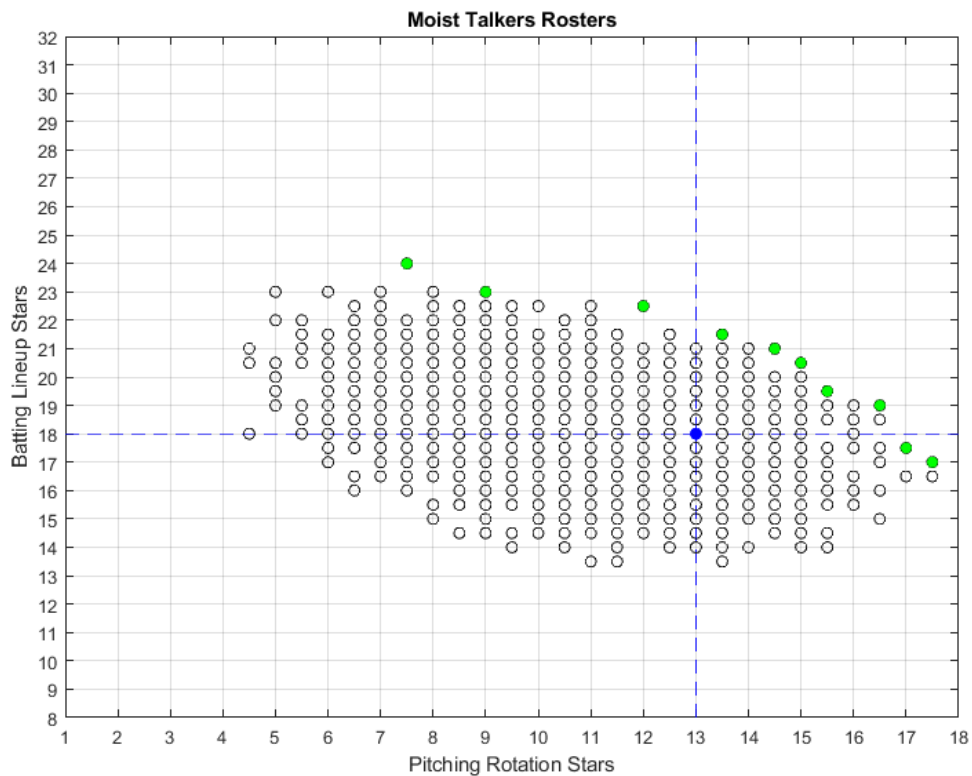
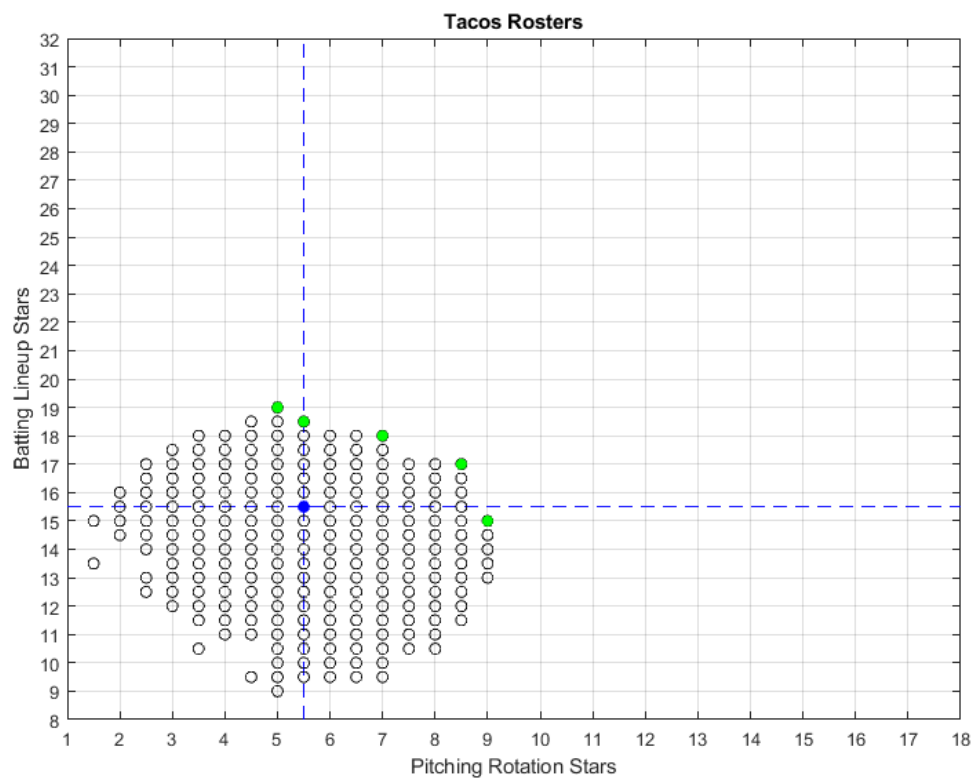**(l)** All unique Moist Talkers rosters
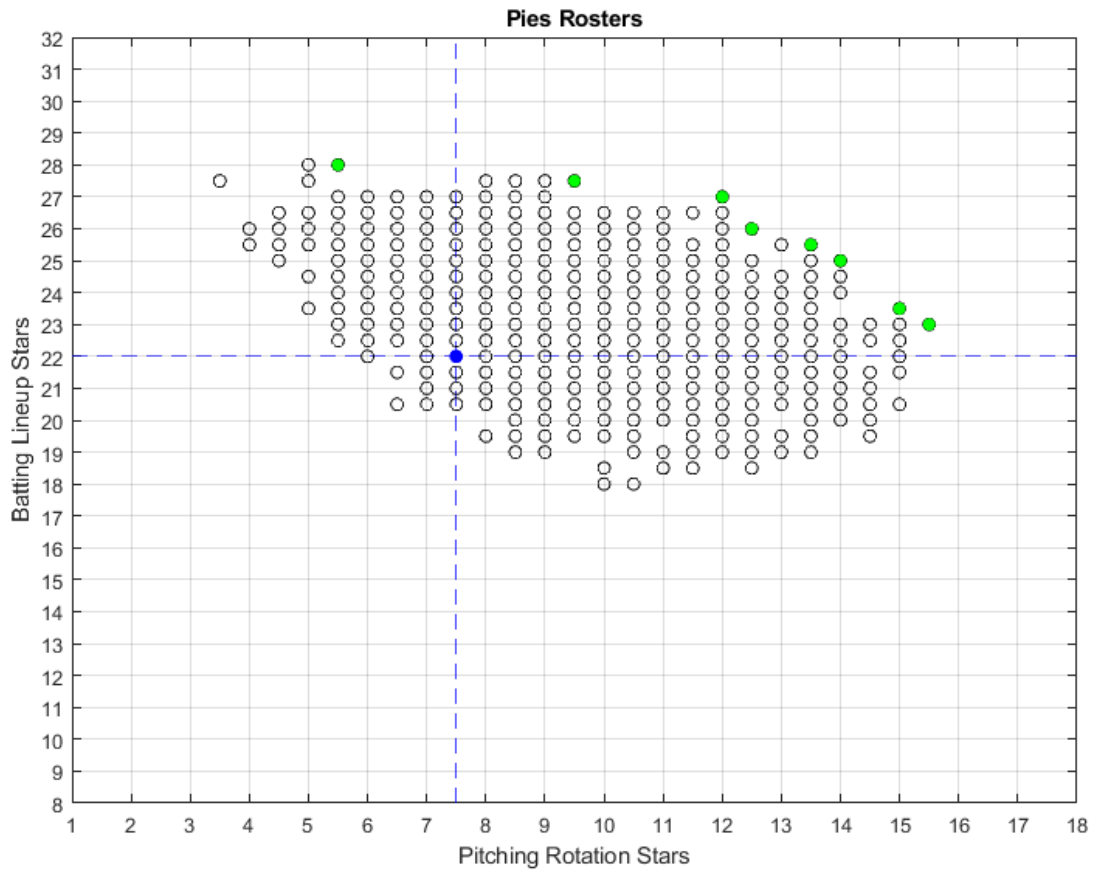
(m) All unique Pies rosters

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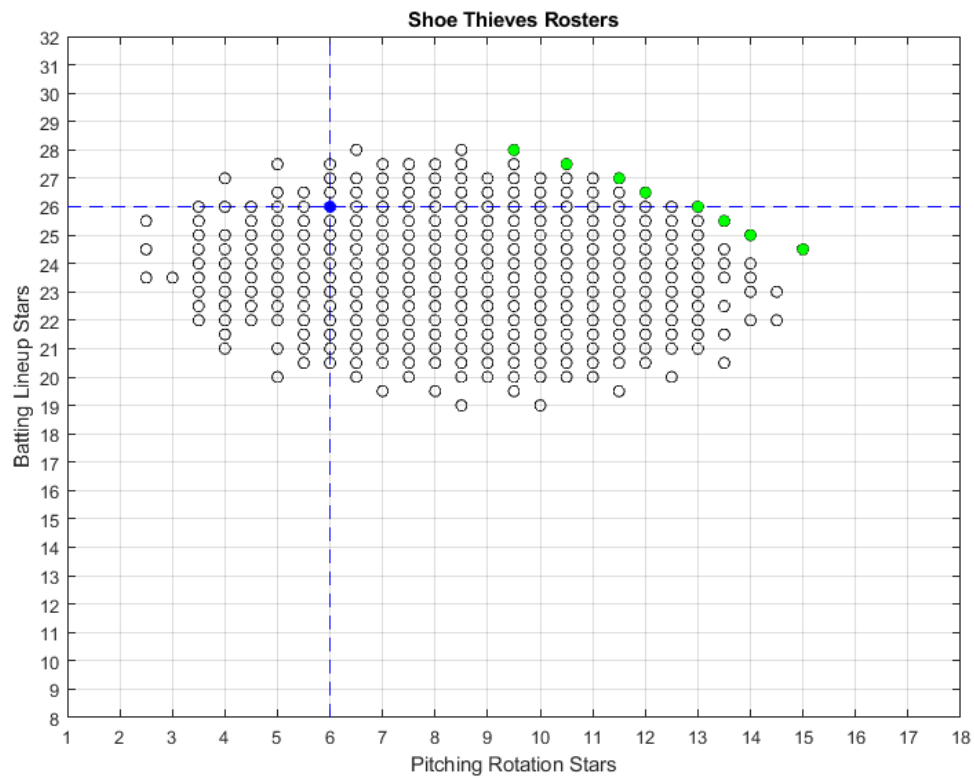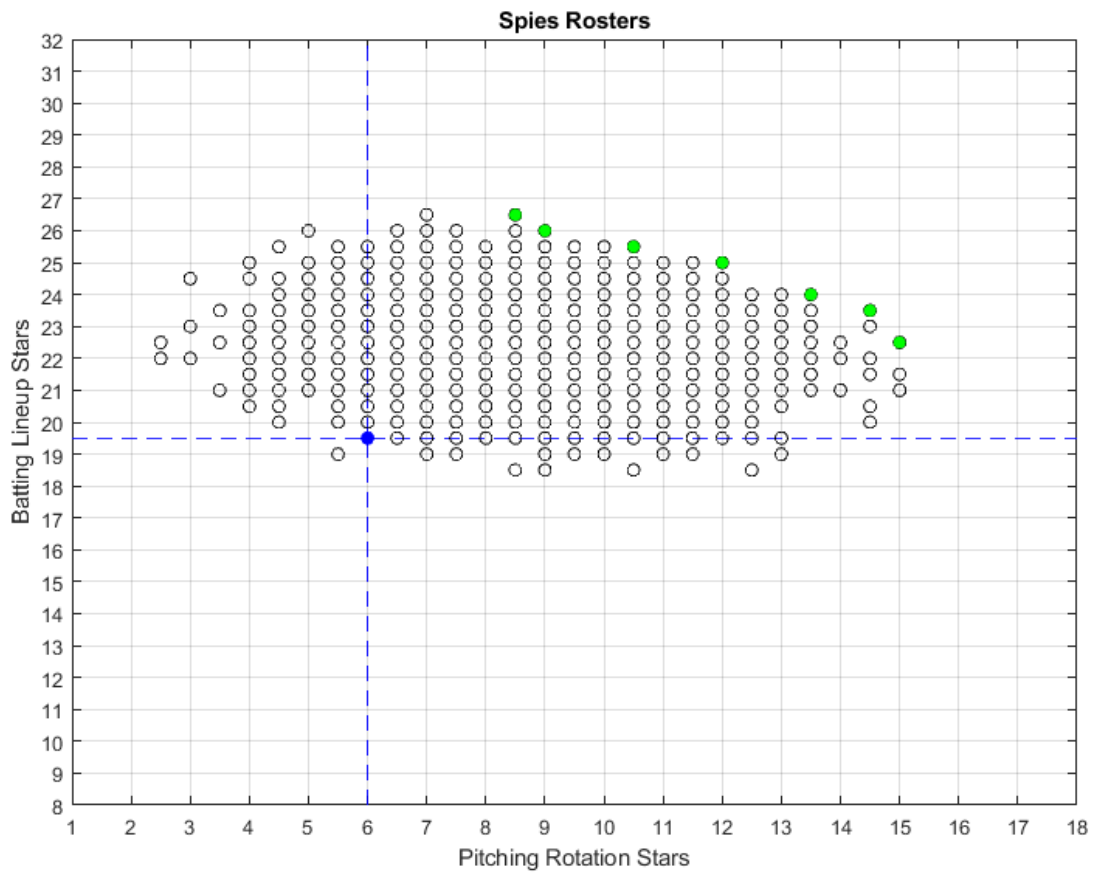
(o) All unique Spies rosters
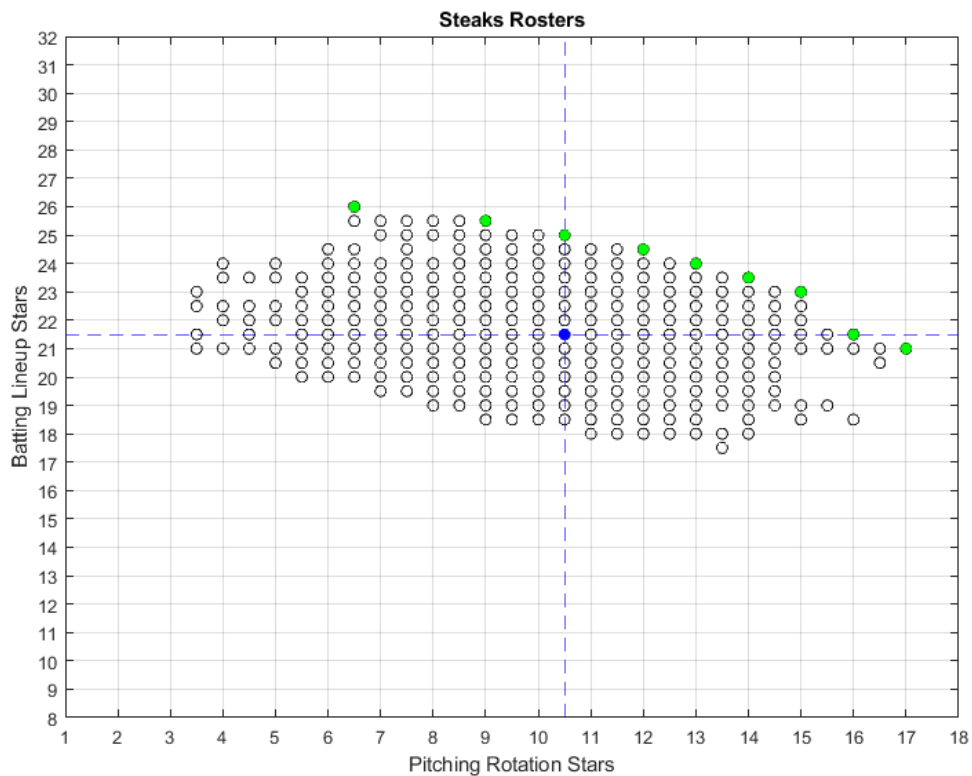
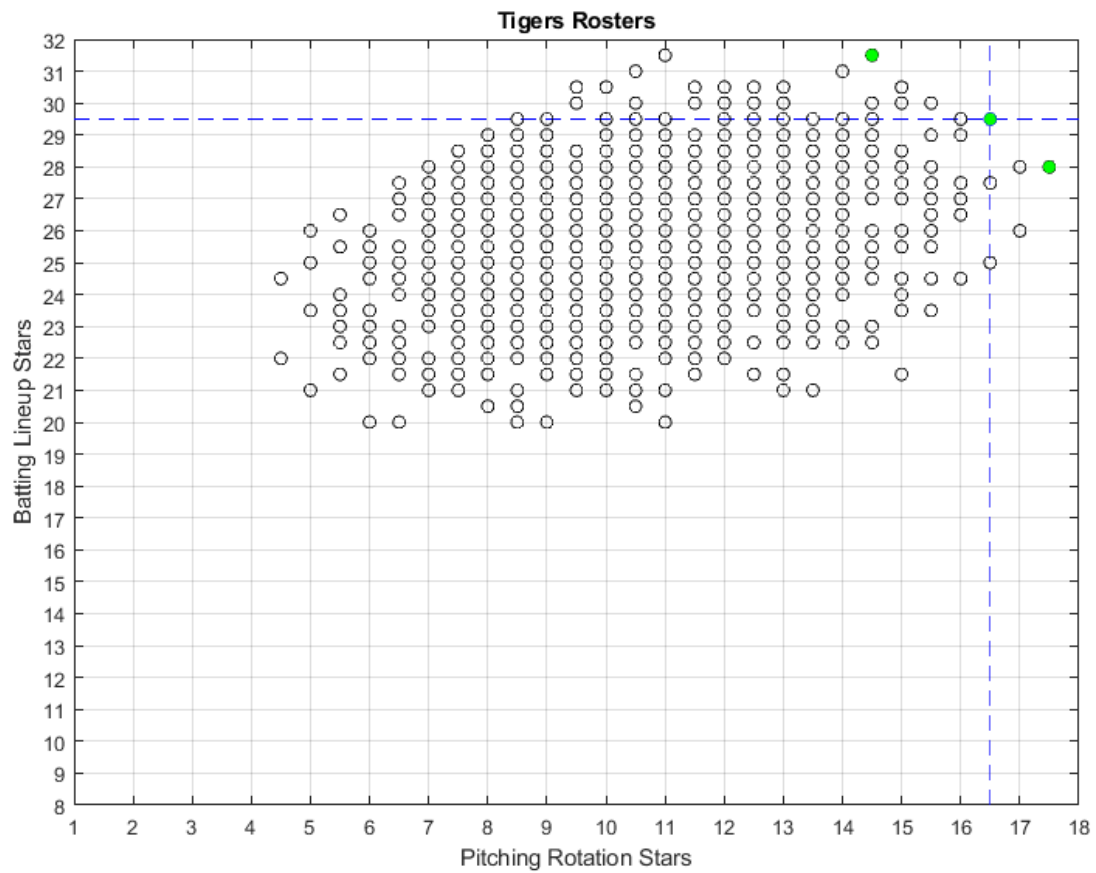**(p)** All unique Steaks rosters

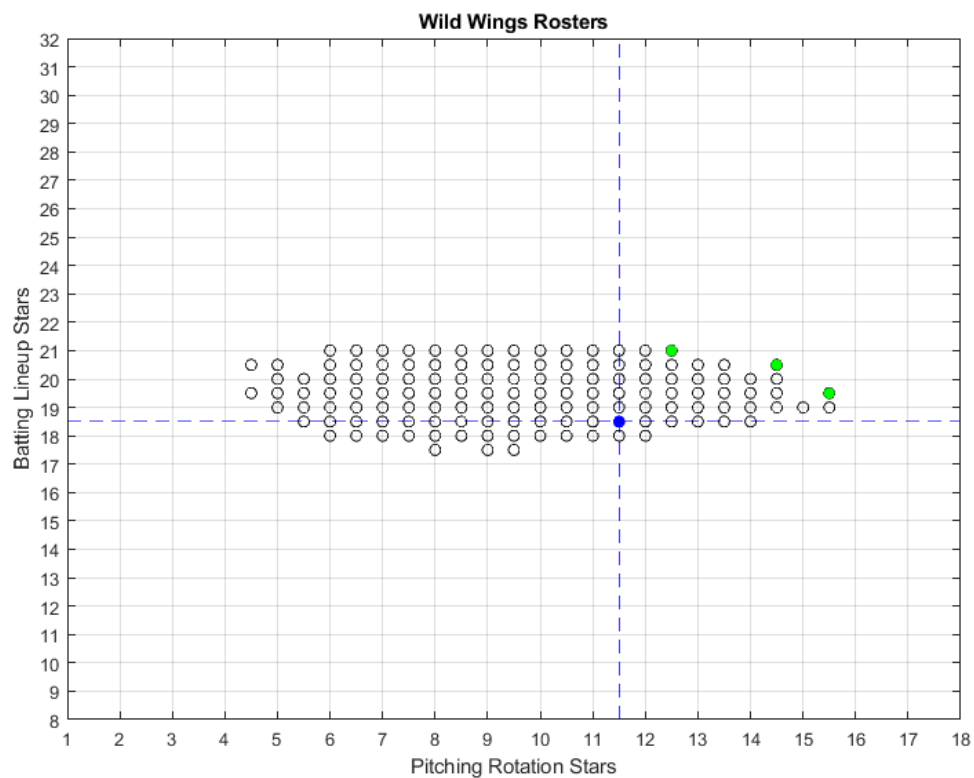SOCIETY FOR INTERNET
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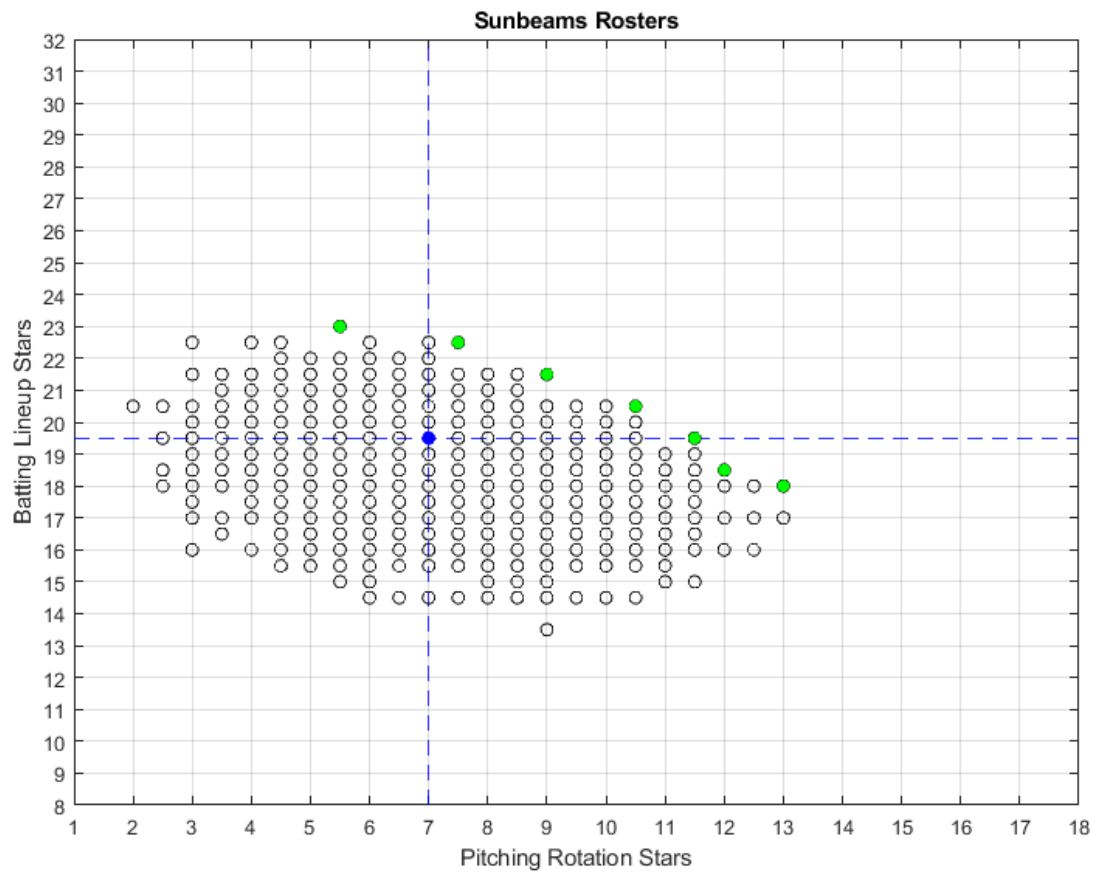
(q) All unique Sunbeams rosters

(s) All unique Tigers rosters

(t) All unique Wild Wings rosters

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