

MIAA POWER RATINGS



Key considerations

1. Transparency
2. Simplicity
3. Accuracy

We can mostly satisfy both the Transparency and Simplicity aspects with a very basic power rating algorithm, that can be easily explained in two parts:

$$\begin{array}{c} \text{TEAM'S AVERAGE} \\ \text{MARGIN OF} \\ \text{VICTORY *} \end{array} + \begin{array}{c} \text{AVERAGE OF} \\ \text{OPPONENTS'} \\ \text{RATINGS} \end{array} = \text{OVERALL} \\ \text{RATING}$$

So when we say this “mostly” satisfies Transparency and Simplicity, we mean there is no secret behind the formula or how to interpret a team’s rating – which you can do by looking at a team’s schedule and results, average out the Margins of Victory (* with some possible “adjustments” that will be explained below) and Opponents’ Ratings, and add them together. Voila!

Unfortunately, the actual math behind the ratings cannot be done (at least easily) with pencil and paper. It would be simple to find a given team’s rating if we knew all its opponents' ratings. But those opponents' ratings depend on *their* opponents' ratings, which depend on *their* opponents' ratings ... etc. So every team’s rating essentially depends on every other team’s rating.

Fortunately, this is easy to do with a computer and a process called ITERATION. Take an initial round of results, enter them back into the formula, then run them again and again. Do it enough times, and eventually it gets to the point where there is little/no change to the numbers and you have your “answer” in the form of power ratings.



This is a similar system to the one used on the Sports-Reference.com sites, so it is non-proprietary, but easily can be modified to suit the MIAA’s needs.

As explained above, it is easy to look at a team's schedule and results, and see how that team's rating was determined. Here is the **NORTHBRIDGE** baseball team from the 2019 season, using Margin of Victory with a cap of 10 runs:

OPPONENT	RESULT	MARGIN*	OPP. RATING	ADJ. MARGIN
Bartlett	W, 13-6	+7	17.65	24.65
Bellingham	L, 11-4	-7	26.11	19.11
Tantasqua	W, 6-2	+4	18.05	22.05
Quaboag	L, 15-1	-10 *	16.62	6.62
Leicester	W, 9-4	+5	17.68	22.68
Southbridge	W, 17-0	+10 *	10.17	20.17
David Prouty	W, 11-0	+10	11.65	21.65
Auburn	L, 4-1	-3	22.48	19.48
Uxbridge	L, 4-2	-2	21.82	19.82
Blackstone Valley	L, 15-4	-10 *	21.72	11.72
Sutton	W, 9-0	+9	20.69	29.69
Oxford	L, 2-1	-1	21.07	20.07
Millbury	W, 2-1	+1	19.02	20.02
Frontier	L, 6-1	-5	22.21	17.21
Uxbridge	L, 11-1	-10	21.82	11.82
Grafton	W, 5-1	+4	21.42	25.42
Nipmuc	W, 4-3	+1	22.85	23.85
Oxford	L, 11-6	-5	21.07	16.07
Auburn	L, 6-1	-5	22.48	17.48
Shrewsbury	L, 11-1	-10	25.98	15.98
AVERAGES		-0.85	20.13	RATING = 19.28

* The game's Margin of Victory exceeded 10 runs ... capped at 10 runs for ratings. (**NOTE: All ratings numbers rounded to two decimal places for display purposes.**)

If you were to look at **BARTLETT**'s results, the game vs. Northbridge would show a Margin of -7, plus an Opponent Rating of 19.28, for an Adjusted Rating of 12.28 for that game.

2019 DIVISION 4 BASEBALL (Margin Ratings ... 10-run cap)

TEAM	W	L	RATING
24 Pope Francis	7	13	21.96
25 Advanced Math and Science	16	4	21.94
26 Monomoy	12	8	21.84
27 Uxbridge	17	3	21.82
28 Blackstone Valley	11	9	21.72
29 Wahconah	11	8	21.70
30 Assabet Valley	10	10	20.99
31 Quabbin	16	4	19.72
32 Northbridge	9	11	19.28
Monument Mountain	8	12	19.22
32 Northampton	7	10	19.21
33 Millbury	11	9	19.02
34 Tyngsboro	13	7	19.00
35 Southwick-Tolland	12	8	18.99
36 Bay Path	11	9	18.75
Northeast	6	11	18.65
37 Lunenburg	10	10	18.55
38 Oakmont	9	9	18.33
39 Clinton	11	9	18.16

From the previous page, Northbridge's Average Margin of Victory (-0.85) and Average Opponents' Rating ... a.k.a Strength of Schedule (20.13) sums to an Overall Rating of 19.28.

That Overall Rating can be seen above – Northbridge would have qualified as the No. 32 seed in a theoretical Statewide Division 4 baseball tournament in 2019, despite a sub-.500 record. *(At 9-11, Northbridge did not qualify for the actual 2019 tournament).*

2019 BASEBALL STATEWIDE RANKINGS (10-run cap)

POS.	SCHOOL	DIV.	W	L	MARGIN	OPP.	RATING	SOS
209	Springfield Central	1	9	11	-1.15	21.49	20.34	172
210	Holy Name	3	9	11	0.30	19.95	20.25	206
211	O'Bryant	3	13	6	3.68	16.50	20.18	285
212	West Boylston	5	17	3	3.60	16.53	20.13	284
213	Fitchburg	2	12	6	2.22	17.76	19.98	245
214	Quabbin	4	16	4	2.65	17.07	19.72	266
215	Greenfield	5	15	5	3.25	16.45	19.70	286
216	Avon	5	12	6	2.17	17.49	19.66	252
217	Greater Lawrence	3	12	8	1.00	18.63	19.63	225
218	Charlestown	2	10	5	1.88	17.88	19.63	227
219	East Boston	2	11	7	2.06	17.43	19.45	254
220	Essex Tech	3	11	9	-0.85	20.29	19.44	192
221	Northbridge	4	9	11	-0.85	20.13	19.28	199
222	Monument Mountain	4	8	12	0.10	19.12	19.22	218
223	Northampton	2	8	12	-2.05	21.26	19.21	214
224	Shawmut	4	7	10	-0.53	19.65	19.13	210
225	Carver	5	4	13	-4.71	23.80	19.10	150
226	Millbury	4	11	9	2.40	16.62	19.02	281
227	Tyngsboro	4	13	7	-0.20	19.20	19.00	215
228	Southwick-Tolland	4	12	8	1.00	17.99	18.99	241
229	Worcester Tech	3	13	7	2.20	16.71	18.91	277
230	Mount Everett	5	12	8	1.65	17.23	18.88	258
231	Holyoke	1	5	15	-2.15	20.98	18.83	179
232	Lynn	5	11	9	1.20	17.63	18.83	248

Because all teams are treated as equal from the start of the season, it also is possible to see exactly how a team rates against all other teams in the state, regardless of division.

Again, a team's Average Margin of Victory, Average

Opponents' Rating, and Overall Rating are displayed ... along with Strength of Schedule (SOS), which is just the rank of the Average Opponents' Rating relative to all other teams.

OK, but what about sports in which a game can end in a tie?

No problem at all ... a tie game simply will have a Margin of Victory of "0" for each team. It doesn't affect the calculation of the ratings, no matter how many tied games a team has.

Here is the **TURNERS FALLS** field hockey team from the 2019 season (8-5-5 regular-season record), using Margin of Victory with a cap of 3 goals:

OPPONENT	RESULT	MARGIN*	OPP. RATING	ADJ. MARGIN
Frontier	L, 2-0	-2	1.58	-0.42
Mohawk Trail	W, 1-0	+1	-2.32	-1.32
Southwick	L, 3-1	-2	-0.80	-2.80
Mahar	W, 2-0	+2	-2.38	-0.38
Holyoke	W, 3-0	+3	-2.88	0.12
Smith Academy	L, 2-1	-1	-0.16	-1.16
Franklin Tech	W, 6-0	+3 *	-3.53	-0.53
Palmer	W, 7-0	+3 *	-4.25	-1.25
Athol	W, 4-0	+3 *	-3.87	-0.87
Amherst	T, 1-1	0	-0.91	-0.91
Belchertown	T, 1-1	0	-0.90	-0.90
Pioneer Valley	T, 0-0	0	-2.49	-2.49
Greenfield	L, 6-1	-3 *	1.26	-1.74
Holyoke	W, 3-1	+2	-2.88	-0.88
Southwick	T, 0-0	0	-0.80	-0.80
Smith Academy	L, 1-0	-1	-0.16	-1.16
Mahar	W, 3-0	+3	-2.38	0.62
Mohawk Trail	T, 0-0	0	-2.32	-2.32
AVERAGES		0.57	-1.56	RATING = -0.98

* The game's Margin of Victory exceeded 3 goals ... capped at 3 goals for ratings.

(NOTE: All ratings numbers rounded to two decimal places for display purposes.)

But what if you don't want to use Margin of Victory?

That's the beauty of the Simplicity of this system. Margin of Victory can be capped at any number – even varying from sport to sport – or used with no cap at all.



Or, Margin of Victory can be completely removed from the formula, simply by treating a victory as a “one-point win” (+1) or a loss as a “one-point loss” (-1). And regardless of the value applied to wins and losses, a

tie game simply is a margin of “zero” (0) for each of the two teams.

The Simplicity of the formula is such that whether Margin of Victory is used at 100 percent, capped (regardless of maximum number), or removed altogether (Win-Loss-Tie only ... +1, -1 or 0), the integrity of the formula is not changed at all.

It also will be easy for the MIAA to show its Transparency, and state exactly what factors it will be using in the formula, for each sport, before the start of the season.

Once again, using the **NORTHBRIDGE** baseball team from the 2019 season as an example, here is the schedule and results with no Margin of Victory ... each win is +1, each loss is -1:

OPPONENT	RESULT	WIN-LOSS	OPP. RATING	ADJ. MARGIN
Bartlett	W, 13-6	+1	0.17	1.17
Bellingham	L, 11-4	-1	1.25	0.25
Tantasqua	W, 6-2	+1	0.25	1.25
Quaboag	L, 15-1	-1	0.30	-0.70
Leicester	W, 9-4	+1	0.16	1.16
Southbridge	W, 17-0	+1	-0.73	0.27
David Prouty	W, 11-0	+1	-0.49	0.51
Auburn	L, 4-1	-1	1.00	0.00
Uxbridge	L, 4-2	-1	0.95	-0.05
Blackstone Valley	L, 15-4	-1	0.61	-0.39
Sutton	W, 9-0	+1	0.72	1.72
Oxford	L, 2-1	-1	0.53	-0.47
Millbury	W, 2-1	+1	0.29	1.29
Frontier	L, 6-1	-1	0.90	-0.10
Uxbridge	L, 11-1	-1	0.95	-0.05
Grafton	W, 5-1	+1	0.78	1.78
Nipmuc	W, 4-3	+1	0.90	1.90
Oxford	L, 11-6	-1	0.53	-0.47
Auburn	L, 6-1	-1	1.00	0.00
Shrewsbury	L, 11-1	-1	1.61	0.61
AVERAGES		-0.10	0.58	RATING = 0.48

However, taking out Margin of Victory can remove some key information to help evaluate how strong a team is. As a result, it can cause teams to shift around in the overall ratings.

2019 DIVISION 4 BASEBALL (Win-Loss only)			
TEAM	W	L	RATING
25 Quabbin	16	4	0.76
26 Tri-County	12	8	0.75
27 Tyngsboro	13	7	0.74
28 Maimonides	9	3	0.73
29 Pope Francis	7	13	0.71
30 Sturgis East	9	7	0.70
31 Ipswich	4	16	0.69
32 Southwick-Tolland	12	8	0.63
33 Blackstone Valley	11	9	0.61
Northbridge	9	11	0.48
Monument Mountain	8	12	0.44
34 Clinton	11	9	0.43
Shawsheen	7	10	0.42
Northeast	6	11	0.38
Bishop Connolly	7	11	0.35
Rockland	0	17	0.32
35 Millbury	11	9	0.29
36 Easthampton	11	9	0.27
37 Oakmont	9	9	0.25

Taking a look at Northbridge again, we now see that removing Margin of Victory drops this team outside of the top 32 in its division ... and with a sub-.500 record (9-11), that is the difference between qualifying for the tournament or not.

In this case, Southwick-Tolland ... which was the No. 35 team with Scoring Margin (at right), moved up to No. 32 ahead of Northbridge using only Wins and Losses.

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TEAM	W	L	RATING
24 Pope Francis	7	13	21.96
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34 Tyngsboro	13	7	18.99
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36 Bay Path	11	9	18.75
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Let's not forget the third key point from the beginning ... Accuracy

The reality is, no set of power ratings ever can be considered 100 percent “accurate.” There always will be cases of a team being rated lower than a team it beat. Any set of power ratings will produce some contradictions ... it's unavoidable. The key is to have as few contradictions as possible. Or, more precisely, to minimize the total magnitude of all the contradictions.

One way to test this is by comparing these formulas, and the power ratings they produce, from the regular season against the actual tournament results from that season in a wide cross-section of sports:

BASEBALL (2019)	BOYS' BASKETBALL ('20, '19)	GIRLS' BASKETBALL ('20, '19)
FIELD HOCKEY (2019)	FOOTBALL (2019, 2018)	GIRLS' LACROSSE (2019)
BOYS' HOCKEY (2020, 2019)	GIRLS' HOCKEY (2020, 2019)	BOYS' SOCCER (2019)
SOFTBALL (2019)	GIRLS' VOLLEYBALL (2019)	

Without getting into too much detail, any set of power ratings did a better job of “predicting” tournament results – i.e., the higher-rated team wins – than seeding by straight winning percentage.

Taking it a step further, these proposed “simple” power ratings were consistently the most accurate across multiple sports ... better than an NCAA Ratings Percentage Index (RPI) style formula, or any other formula based solely on linear algebra.

With a straight points system-type formula, a team's rating is influenced only by the other teams it plays. RPI takes it one level deeper by also using "opponents' opponents," but still works from a limited pool of data – oftentimes, a team's opponents also will play mostly similar schedules.

With this system, because every team's rating depends on every other team's rating, all teams can be "connected" in some way (*except, in very rare cases, when an entire league has no out-of-league opponents*).

And because every team has the same starting point in a given season – there are no point values or other "bias" taken into consideration – there is no penalty for a team to face a good Division 3 opponent vs. a weaker Division 1 opponent. Also, a team's rating can't be easily distorted by facing opponents with strong records against weak competition.



What are the drawbacks to this system?

No power ratings system is perfect. Relying simply on Margin of Victory does have some flaws ... i.e., an uncapped 20-point win and a 5-point loss (+15) will be more beneficial than a pair of 5-point wins (+10).

Removing Margin of Victory solves this issue, but opens up another ... using straight Wins-Losses means one team's 1-point win and another team's 20-point win against the same opponent are treated exactly the same – which is a flaw with RPI and other similar systems.

CONCLUSION

- A power ratings system using Margin of Victory -- in some form – is the most accurate way to seed a statewide tournament, that is most likely to have the “best” teams at the top and in the best position to play for a championship.
- Removing Margin of Victory and placing emphasis strictly on Wins and Losses, while not quite as accurate overall, still is a better method of power seeding a tournament than RPI, straight winning percentage, or any similar formula.

