Heuristic Analysis

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The three evaluation functions are listed below:

- Student1:
  - Calculate the weighted average of difference between player's legal moves and opponent's legal moves. When calculating the difference, the weight of opponent's legal moves will become bigger as the game starts. The purpose of changing weight is I want player to go after opponent as the game starts.
- Student2:
  - The second formula based on the first formula but the weight of opponent's legal moves will become bigger and sooner than first formula. It means that the attitude of player going after opponent is more aggressive than the first formula.
- Student3:
  - Calculate the ratio of difference between player's legal moves and opponent's legal moves to the number of available positions on the board. When calculating the difference, it's the same as previous two formulas. The purpose of dividing by the number of available positions is that the difference of two players moves become more critical as the game reaches to the end.

Table 1. shows the number of winning and losing for each evaluation functions.

Table 1.							
	Random	MM_Null	MM_Open	MM_Improved	AB_Null	AB_Open	AB_Improved
ID_Improved	339/61	343/57	339/61	336/64	339/61	324/76	337/63
Student1	336/64	343/57	335/65	342/58	328/72	335/65	349/51
Student2	332/68	336/64	345/55	339/61	339/61	337/63	351/49
Student3	351/49	329/71	355/45	339/61	340/60	344/56	351/49

Table 2. shows the winning rate for each evaluation functions.

Table 2.							
	Random	MM_Null	MM_Open	MM_Improved	AB_Null	AB_Open	AB_Improved
ID_Improved	84.75%	85.75%	84.75%	84.00%	84.75%	81.00%	84.25%
Student1	84.00%	85.75%	83.75%	85.50%	82.00%	83.75%	87.25%
Student2	83.00%	84.00%	86.25%	84.75%	84.75%	84.25%	87.75%

Student3	87.75%	82.25%	88.75%	84.75%	85.00%	86.00%	87.75%

I use winning rate from table_2 to plot following figure. We could see not single evaluation dominate the each competition. But Student_3 outperform others when facing MM_Open and Random players.

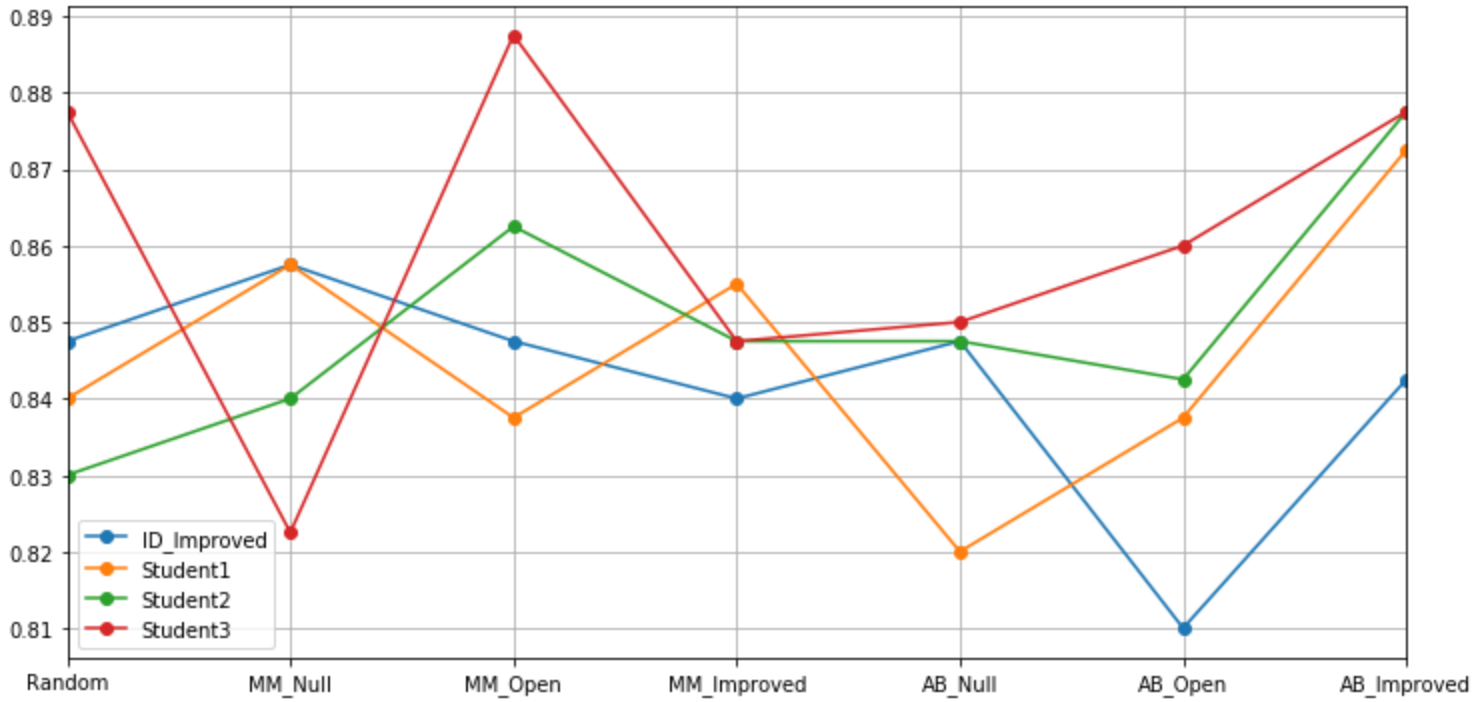

Table 3. shows the overall winning rate for each evaluation functions.

Table 3.				
	ID_Improved	Student1	Student2	Student3
Overall Winning Rate	84.18%	84.57%	84.96%	86.04%

Based on the above tables and figure, I recommend to use Student_3 as the best evaluation function. The reasons are,

1. Student_3 has the best overall winning rate. And it's almost 2% more than ID_Improved.
2. The idea behind the formula makes more meaningful than the others, which is, the difference of two players moves become more critical as the game reaches to the end.
3. The complexity of denominator is less than the others.