Ranking System in terms of Diversity: a case study using admission process

Tokiyo Yamamoto[1)], Tsuyoshi Hashimoto[2)] and Hiroyuki Iida[1,3)]

[1]Department of Computer Science, Shizuoka University
[2]Department of Engineering, Shizuoka University
[3]Information and Systems, PRESTO, Japan Science and Technology Agency

Abstract. This paper concerns a ranking system in terms of diversity. In the sense of round-match games a ranking system is a multi-player meta-game like a tournament. In the game each player may not necessarily play a game against other players, instead play against a standard player. The outcome of the game may be not a win or loss but score. We recognize that the admission process is such a meta-game where several subjects such as English and Math stand as standard players. To keep the fairness and diversity in the meta-game we propose a new ranking system for admission process. Simulation experiments to evaluate and compare with the traditional system are performed. The experimental results show the effectiveness of the proposed idea.

1. Introduction

Round match for two-person games such as chess and RoShamBo are the level 1 meta-game [1]. Tournament systems are typical examples of round matches with multi competitors. When competitors cannot play against all others, i.e., the round robin cannot be performed, the tournament will be pairing systems such as the Swiss System. A tournament is a general form of the round match by plural competitors.

Here let us consider another kinds of tournaments in which competitors do not play games directly against other competitors, i.e., competitors play games against a common player. The outcome of such games will not be win or loss but score points. Admission processes are a kind of such tournaments. A competitor would take a score for each subject in the tournament. Admission processes are level 1 meta-games.

This paper discusses about well-refined selection, i.e., well-optimized game programming, using admission processes as level 1 meta-games. Iida [2] pointed out that sophisticated games have fairness, uncertainty (or diversity) and harmony. We examine how such nature of games should be reflected in meta-games.

It will be obvious that fairness is important to evaluate current ability correctly for ranking of admission processes, the potential ability of each competitor and the diversity of successful candidate groups are also important [3] [4].

In this study we propose a new admission process using the total of K-power of each subject score (we call it as 'K-power system'), standard deviation, round-robin tournament and ranking system with SB points for examining diversity and fairness in meta-games and evaluate its effectiveness by simulation experiment.

2. Method

We assumed an admission process simulation of five subjects (Japanese, Mathematics, Science, Society and English) examination for thirty competitors. Selection will be performed in two stages and ten successful candidates will be finally selected. Winning points are used for the ranking in the case of tiebreak in the secondary stage. Successful candidates will be selected at random in the case that even winning points are same.

In the primary selection stage the K-power system or a standard deviation system is used. The K-power system order is performed with a sum of the powered score of each subject, and top fifteen candidates for k ($1 \leqq k \leqq 5$) will be passed. This system is expected to make an environment of diversity where candidate are easy to improve. The standard deviation system orders candidates with standard score of each subject, and top ten candidate of each subject will be passed. This removes out 'likes and dislikes' and or difficulty fluctuations of tests.

The secondary selection stage goes using the round-robin system or SB system among the group of successful candidates after the primary stage. In the round-robin system an initial point is zero, plus one point when candidate's subject score is higher than the other, minus one point when the candidate score is lower than the other and plus zero point when both candidates' scores are even. Top ten candidates will pass this exam. When the total scores are completely even at the tenth place, the successful candidate is determined at random. The SB system adds the loser's subject score on the winner's SB points and initial SB point is zero.

The degree of the difficulty among different subjects is smoothed by using the round-robin system in the secondary selection. As the results it considers the real ability (or strength) of competitors and satisfies the fairness. Moreover, we expect that the fairness using SB system would be much higher than using the round robin.

Table 1: candidates' score of each subject

No	Japanese	Math	Science	Society	English
1	80	87	64	72	90
2	55	55	55	55	55
3	50	50	50	50	50
4	52	51	49	50	48
5	55	52	55	33	55
6	60	20	45	51	39
7	38	48	47	32	50
8	44	55	32	36	48
9	28	39	50	49	48
10	49	32	28	51	53
11	50	45	35	25	55
12	62	30	27	33	54
13	49	39	28	51	37
14	42	40	52	25	41
15	28	39	33	49	48
16	40	29	34	51	39
17	52	30	20	59	32
18	22	40	32	25	71
19	29	28	40	50	40
20	18	70	30	27	39
21	62	10	40	50	20
22	34	58	47	22	21
23	62	20	27	13	54
24	18	20	26	50	62
25	17	35	43	28	53
26	50	45	35	25	19
27	53	29	34	12	40
28	20	19	23	40	39
29	18	36	31	27	24
30	0	60	28	32	7

3. Results

Let us show an example of our simulations. We performed simulations in some patterns considering the ranking of the K-power system or score distributions. The form of score distribution is given in Figure 2. The number of Table1 and Table2 are the same with the ranking by the K-power system.

The table below shows the combination of the primary and second selection system.

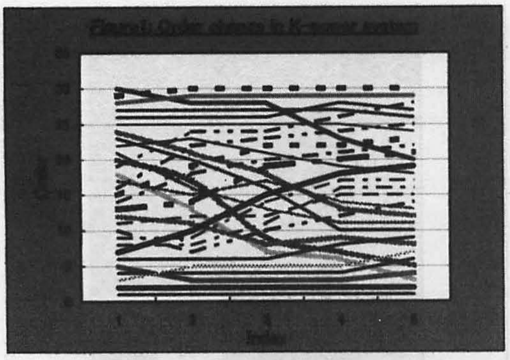
Secondary \ Primary	Total of K-power	Standard deviation
Round-robin	K-R system	T-R system
SB	K-SB system	T-SB system

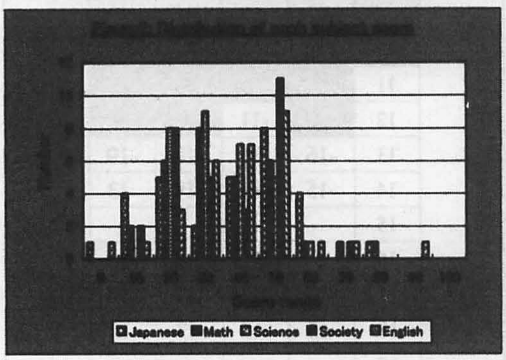
Table 3: Result of each system

No	K-R	T-R	K-SB	T-SB
1	1	1	1	1
2	2	2	2	2
3	4	4	4	4
4	5	5	5	5
5	3	3	3	3
6	7	7	6	7
7	-11	10	-14	-11
8	8	8	-11	8
9	-12	-12	-15	-12
10	9	9	9	10
11	6	6	8	6
12	10	-11	7	9
13	-16	-16	-18	-19
14	-15	-13	-19	-13
15				
16		-17		-20
17	-17	-18	-17	-16
18	-13	-15	-13	-15
19				
20	-19	-21	-20	-21
21	-14	-14	10	-14
22		-19		-17
23	-18	-20	-12	-18
24	-20	-22	-16	-22
25				
26				
27		-23		-23
28				
29				
30		-24		-24

■: passed candidate of each system

Each number is ranking of each system, each negative number is the fail candidate by secondary selections, and the blank is the fail candidate by primary selections.





4. Discussions

Figure 1 shows that the changes of the ranking when using the K-power system mainly appear in the group of the middle ranking competitors. Due to the use of the power of scores, the larger an index number, the larger a radical root explosively. We then see less influence by K-power to the top (highest) and bottom (lowest) group of scores. That is, the ranking for the top and bottom competitors are stable regardless of the ranking process.

Moreover, we simulated with other data which distribution of score is narrowed and it makes the change of the ranking remarkably. But the change of the ranking is not seen at the secondary selection very much. The higher rank of the total of 5-powered of each subject does not so many times become a successful candidate. However, the higher rank of the total of 5-powed of each subject (he/she is about 20^{th} of the ranking in the traditional system) successes by K-SB system (see No.21).

We here consider the K-SB system and T-SB system. Each system uses the SB system to measure the difference of strength, so their group of passed competitors changes, and then the result becomes different. The K-power system emphasizes stronger subject scores, and it dose not emphasize weaker subject scores so much. So, in the K-power system, if one has a weak subject but has any strong subject, he/she is easy to win.

However, the standard deviation system emphasizes not the external score but the order of each subject score, so it emphasizes the order of each subject.

This simulation of SB system based on the simple total, shows how the higher ranked person of a subject does not have a leg pulled by the poor subjects below but can show strong subjects.

The SB system will be more useful than the traditional one if it aims that the growth of the strong portion or the improvement of weak portion by other strong portions.

However, they are easy to fail the exam in mentioned four systems in the following cases: There is no subject that has especially higher ranked but the total point is high to some extent, or there is no favorite subject. It is better to use the traditional system for candidates like above.

Moreover, by four neither of the systems, the 3th place of a higher rank changed. Therefore, a certain candidate good at every subject has checked what is passed by every system.

As mentioned above, the system by which K-power system evaluates the high portion of the standard score, the system by which the standard score evaluates both the high portion of the standard score and a low portion, the system by which the round robin evaluates the subject ranking, and SB can be called system by which the subject ranking and marks are evaluated.

Fairness and diversity in meta-game

Let us consider the diversity and fairness of the meta-game in the domain of the admission process. Competitors do not compete against each other in the admission process but against each subject to measure individual ability. And, considering a successful candidate group's possibilities, the diversity (group's diverseness of a vector) as the whole becomes important.

Next, Let us consider the fairness. Board games maintain the fairness in keeping the balance between two players in the sense of the statistical winning percentage. Namely, it is not fair if there is such a difference in the initial position. But in a meta-game like the admission process, if standard players have any deviation (greater or lesser), the initiative for White or Black will arise. Therefore we proposed the round robin or SB for the admission process in this paper and they help to know candidates' relative position. This may not be dependent only on the character of a standard player but it is expected to lead more objective evaluation for candidates or the admission process and it will be connected with the fairness as a meta-game.

Next, we think of diversity. By the data obtained in the simulation experiments, when considering the whole diversity, a part of diversity was also produced as a result. Moreover, the importance of diversity will be the importance of balance in the whole as based on not only present ability, but also individual ability in the future, and the diversity leads to the successful candidate group changes. This means that the worth of marks of a subject eye changes by the candidate group. However, the fairness maintains a balance by evaluating the high score of subject marks in every index subject of which group, curiosity and a sense of rivalry are raised, and it is expected that the environment where the whole group tends to grow may be able to be made.

Therefore, the system proposed in this paper can realize the admission process bringing the environment that has diversity and helps to improve each other.

5. Conclusion

In this study we proposed an admission process as a level 1 meta-game and a new ranking system combined with some ideas. The admission process will be refined more in the sense of the fairness and diversity. Our simulation showed that the fairness and diversity could be taken over from the traditional ranking way using the simple sum scores.

References

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