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The schedule of World Cup and its impact on the team

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ABSTRACT

This paper discusses the organization of the World Cup competition, in which through the establishment of a number of scheduling model, the use of analytic hierarchy process and stochastic simulation and other methods to solve this problem and obtain a more reasonable arrangement of the competition.

For the arrangement of the Order of the game, first of all, the existing competition is studied. On the premise of the increase in the number of teams and the previous arrangement of the group points, it is considered from the appropriateness of the field, whether the schedule is wonderful, whether the arrangement is simple and whether the ranking is reasonable. 3 new competition competitions are proposed for the improvement of the original competition. Then, the analytic hierarchy process is used to compare and analyze the 3 new competition methods, and the optimal competition method is selected.

Finally, under the previously established game, FIFA's integral algorithm formula is used to analyze and calculate the impact of the results produced under the competition on FIFA rankings. In the application of formula calculation, the stochastic factor is introduced, and the results are simulated by computer, which can get the approximate upward trend of the team in different ranking intervals.

Keywords: World Cup schedule; Analytic hierarchy process; Computer simulation

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1. INTRODUCTION

The FIFA World Cup, referred to as the "World Cup", is the world's most coveted sacred glory in the field of football, but also the ultimate dream of all football players in various countries (or regions). The World Cup is held every four years, and any FIFA Member State (region) can send a team to sign up for the event. The World Cup is the source and foundation of the development and popularization of football, so it is also known as the "Cup of Life".

A total of 32 teams took part in the final stages of the World Cup in 2018, using the group plus knockout approach. The 32 teams were divided into eight teams, each with four teams, each of which had to play with the other three teams and play only one game, with 4 teams in each group playing a total of 6 games. Each group points of the top two teams out into the knockout stage of the 1/8 final, a total of 16 teams, followed by 4 rounds of knockout until the ranking, lasted one months to play a total of 64 games.

But starting in 2026, the team will increase to 48 units. Due to time constraints, a team can't play too many games. As a result, FIFA has proposed a change in the competition, with each group changed from 4 to 3, with the first two teams eligible for the second round.

In order to stay excited, there can't be too many games in the game, and the results won't affect the team's qualifying. In order to compete fairly, there can not be too many games, collusion is beneficial to both sides, the final result of the game should not contain a lot of luck factors. So the study of how to arrange the order of the game and the impact of the final results on Coca-Cola's FIFA rankings is crucial to the game as a whole.

2. Analysis of the competition

2.1 Knockout

The knockout is that the participants play according to a certain combination, the negative are eliminated, the winner continues to play, to win the title runner-up.

The advantage is to complete the whole game with the fewest field, the economy is fierce. The disadvantage is that the weak team learning to observe less opportunities, and the two strong encounter prematurely and be eliminated, there is no justice. Knockout because of the competitive process of the opportunity is strong, the result of the competition is large, although seeds, wheel and so on as a technical supplement, but its defects can not be completely overcome. We don't want the game to have too many luck factors so we can't simply choose a knockout.

2.2 round robin

Round-robin competition is a kind of sports competition in which teams take turns to compete with each other in a certain combination and finally decide the ranking based on the result of all competitions. In a round-robin competition, each competitor must compete against all competitors except themselves and complete all sessions. The round-robin competition can obtain the results of all the matches, so as to arrange the ranking of all the contestants, and the ranking results can objectively reflect the level differences of each participant.

However, there are two hidden dangers in round-robin competitions. Second, in the process of completing all the games, not every game is related to the final ranking, so the round-robin game is likely to appear in the prevarication and falsification phenomenon. We don't want to have too many games that don't interfere with qualifying and we don't want to have too many games where teams are colluding in ways that are mutually beneficial, so we can't just use ro-

und-robin games.

2.3 grouping cycle plus elimination

Grouping cycle plus elimination is a competition system that absorbs the advantages of round-robin system and elimination system. The grouping cycle is to divide all participating teams into several groups for the first stage of preliminary competition, and then between the winning teams of each group for the second stage of the final, to determine the ranking. The single cycle competition method is adopted in the group preliminary competition, and the single cycle competition, parallel competition and cross competition can be adopted in the final competition. Therefore, this competition method is also called mixed cycle system. The grouping cycle is suitable for competitions in which more teams participate, and the competition tasks can be completed reasonably and fairly within a short period of time.

Therefore the World Cup usually USES this kind of competition system, first divides the group to carry on the group circulation integral, after promotion according to the rank again carries on the elimination match, guaranteed the weak team to play the field not to be too few also reduced some fortuity, finally used the elimination match to also guaranteed the competition intense and the viewing point.

The shortcoming of the grouping cycle is that the teams are different in strength. If they are not evenly distributed, the strong teams may be cut in advance and the weak teams may be placed in front. In order to overcome this defect, a "seeding team" should be set up in the ar-

angement. The so-called "seed team", is the strength and the result is relatively strong team, should be reasonably separated; The seeding team can be determined through negotiation or according to the ranking of the previous competition. We assume that based on the known seeded teams in previous matches and rankings, the seeded teams will be equally divided into groups to avoid the strong and strong meeting early.

Therefore, the method that requires the best scheme to arrange the competition order in advance needs to make clear what is the best competition arrangement system, and then consider the specific arrangement of the competition time and strength of each team. In order to determine the best competitive arrangements, we need to know what the arrangements are and determine the criteria to judge them quantitatively. As suggested by FIFA, the first round is a group round with 32 teams entering the second round after reaching the last two of the last three. Therefore, this paper gives three schemes based on the advantages of round-robin competition and knockout competition, respectively explores their optimal arrangement, sets the optimal and benign indicators of the competition system through the analytic hierarchy process, and makes comparative analysis to select the best competition system and arrangement.

3. Proposal of the scheme

In order to meet the needs of World Cup event arrangement, we propose the following three schemes: Scenario I:

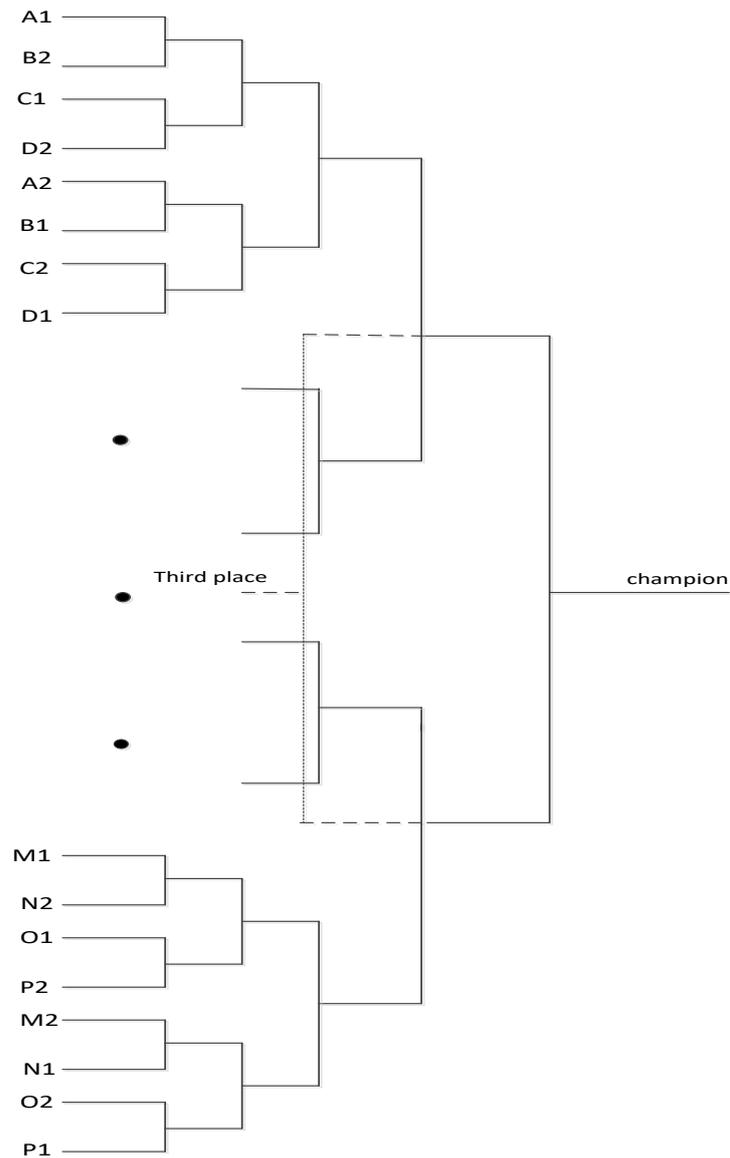


Figure1: Schematic diagram 1

On the premise of 3 into 2, there are 32 teams left after the first round of the breakout. This program is followed by a single knockout, and in order to avoid early encounters, we let the first place in each group of the group play with the second place in the other group.

This not only ensures the strength of the strong team out of the probability and the strength of the weak team into the next round of the probability is small, and has the strength of the team to play, to ensure the game.

After the previous knockout round, there are 16

teams left, and they are randomly assigned to a second knockout round to determine the top eight. Another round will determine the top four, the top four will be a round of competition, the victory of the two teams as a candidate for the championship, the failure of the two teams again round, will determine three or four, the last natural is the championship battle, so after the previous division and 32 elimination games, a total of 80 games on the end of the game.

Scenario II:

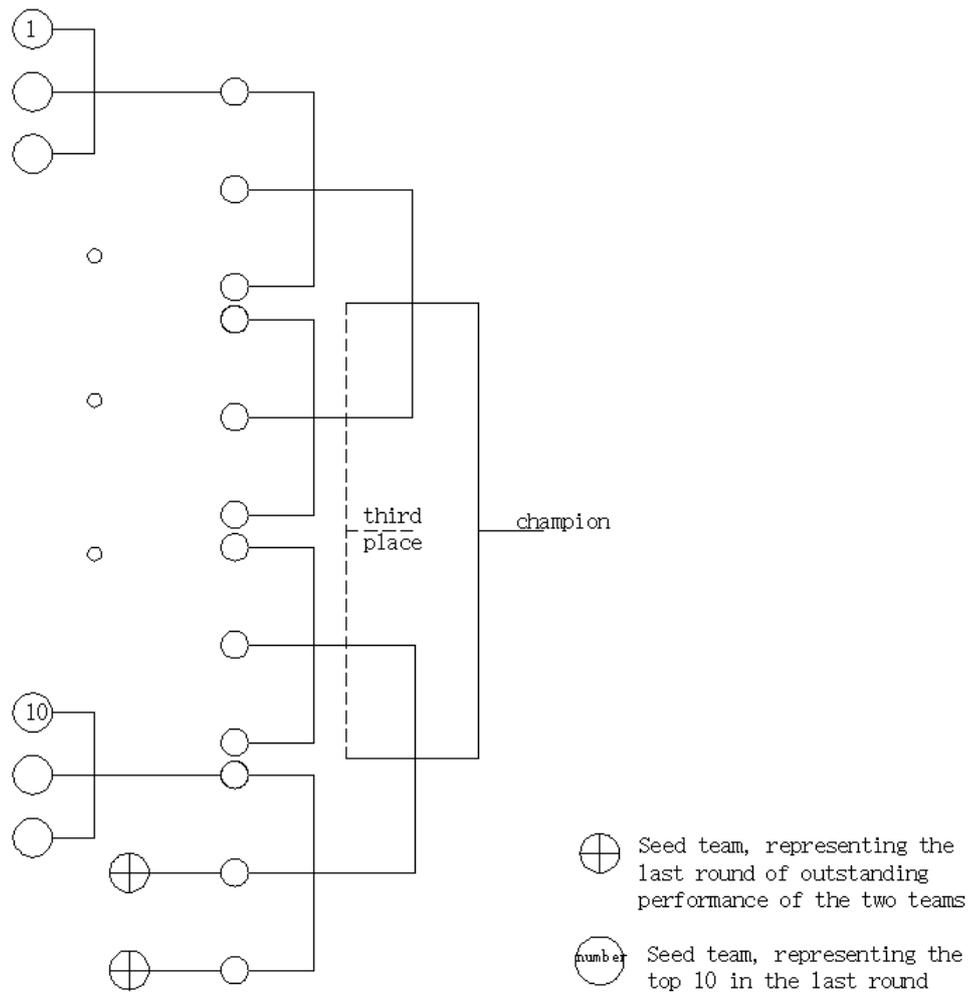


Figure2: Schematic diagram 2

After the first round of the group Points race, we will have a rough ranking. We propose that the two teams that performed particularly well in the first round of the division skip this round and go straight to the next round. And this round is divided into 10 groups, in addition to the selection of the two groups, the previous points in the top 10 separate into 10 groups. The two teams left in each team are filled by random lots, with each group of three teams having another cycle points race, and this time three teams pick one, and only one team can get out of the group. After this round, plus the two teams that were promoted earlier, there were 12 teams. Then randomly divided the 12

team into 4 groups, each group of three teams, repeat the last round of arrangements. three teams to advance to another team, then four groups will get four teams, that is, the top four. This arrangement is to enable the teams to play their full strength and avoid losing their chances by accidentally playing an aberration, but this can lead to too many games.

The top four to another round of knockout, the victory of the two teams as a champion candidate, the failure of the two teams than a round, decided three or four. And the last one is also the title race, so after three rounds of cycle points and the final two rounds of the knockout, a total of 98 games.

Scenario III:

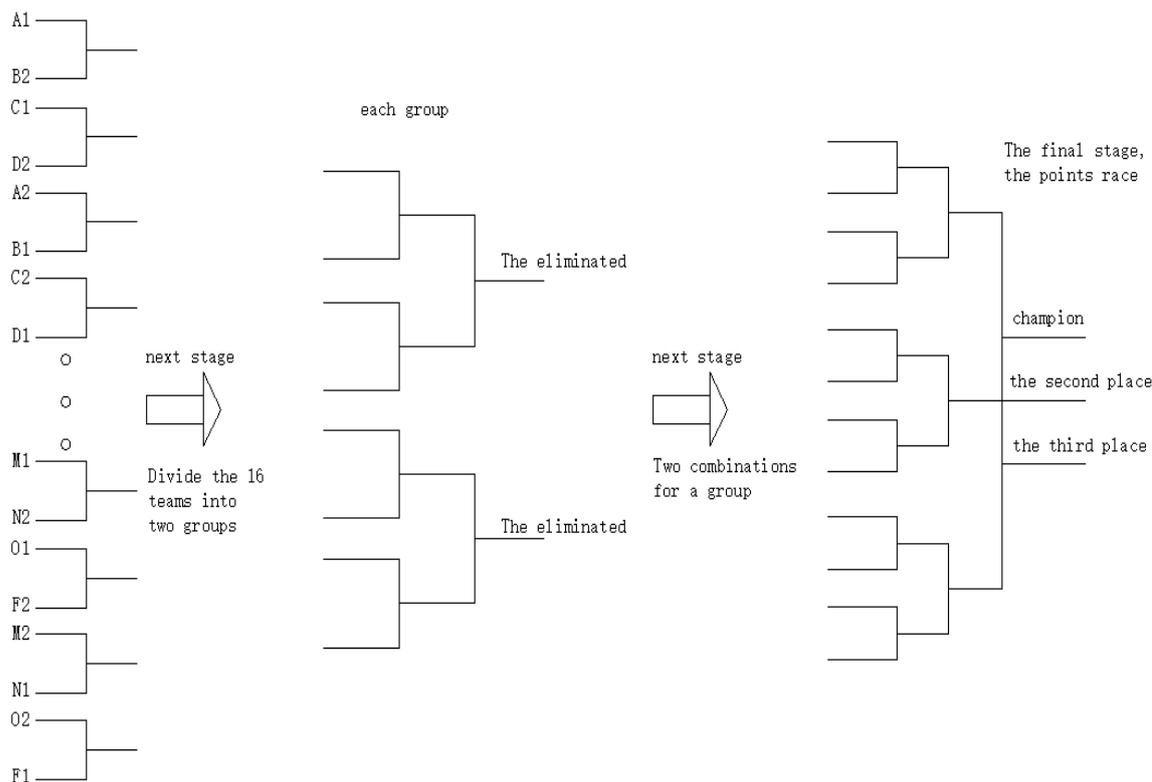


Figure3: Schematic diagram

After the first round of the group stage, we had 32 teams out. In order to ensure the tension of the schedule, we will use a single-wheeled knockout in the next round, so that we can get 16 teams, dividing them into two groups, each group of 8 teams. Eight teams to compete with each other to produce four wins and four losses, four negative teams to play again, to get two wins and two losses, at this time two negative teams eliminated. In this round, four teams in the two groups were eliminated, with a total of 12 teams left. With this multi-round knockout can let the strong have more strong chance to win the title, and the weak also reasonable out do not leave regret.

The remaining 12 teams, in order to ensure the tension of the schedule once again, this round and the use of a single-round knockout system, came to the top six. The top six play each other

again to reach the top three. The last three use a round of cycle points, in order to ensure the last one for the grand final, let the first loser and the third team first, the winner and the first winner of the grand final, so as to arrive at the second runner-up of the crown. In this way, the three kinds of competitions are integrated with each other, combining the advantages of the three, effectively avoiding the drawbacks of the three separate competition, a total of 88 games.

4. Final selection of the scheme

4.1 Establish a hierarchical comparison model

The target layer involved in this question is the excellent index of the competition system. The criterion layer consists of four parts, which are appropriate for the event, wonderful highlights, simple arrangement and reasonable ranking.

The program layer consists of three schemes we have developed, as shown below:

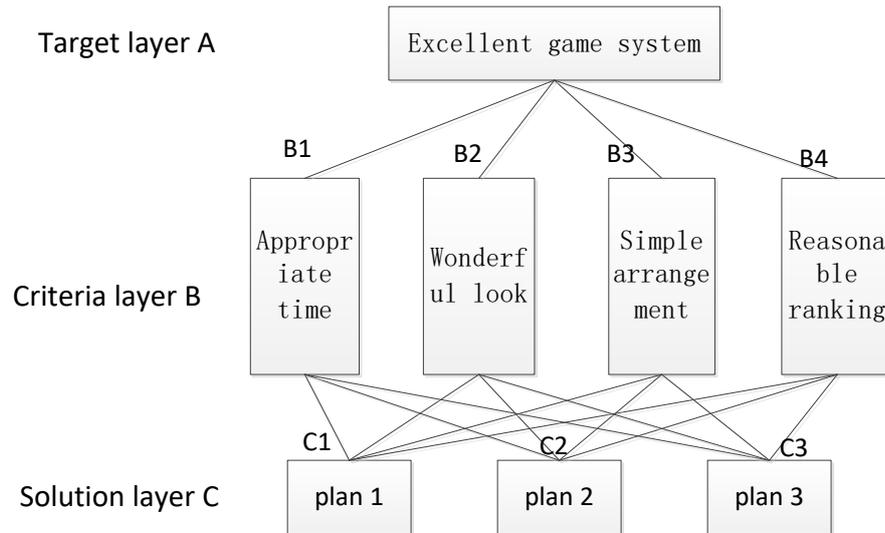


Figure 4: The schematic diagram of Analytic hierarchy process

4.2 Constructing a pairwise comparison matrix Set the judgment criteria to be:

Scaling	meaning
1	Expressing the same importance compared to two factors
3	Compared with the two factors, the former is slightly more important than the latter
5	Compared with the two factors, the former is obviously more important than the latter.
7	Compared with the two factors, the former is more important than the latter.
9	Compared with two factors, the former is more important than the latter.
2, 4, 6, 8	Indicates the intermediate value of the above adjacent judgment

The judgment matrix of the criterion layer is as shown in the following table:

Table 2: Judgment matrix of the criterion layer

A	B1	B2	B3	B4
B1	1	2	4	1
B2	1/2	1	3	1/2
B3	1/4	1/3	1	1/4
B4	1	2	4	1

The judgment matrix of the solution layer is shown in the following table.

Table 3: Decision matrix

B1	C1	C2	C3	B2	C1	C2	C3
C1	1	2	1/2	C1	1	3	2
C2	1/2	1	1/4	C2	1/3	1	1/2
C3	2	4	1	C3	1/2	2	1

B3	C1	C2	C3	B4	C1	C2	C3
C1	1	2	3	C1	1	1/2	1/3
C2	1/2	1	2	C2	2	1	1/2
C3	1/3	1/2	1	C3	3	2	1

4.3 Consistency test

A positive reciprocal matrix that satisfies the following relationship is called a consistency matrix.

$$a_{ij}a_{jk} = a_{ik}, \forall i, j, k = 1, 2, \dots, n$$

The constructed (reciprocal) judgment matrix A needs to be checked to see if it is seriously inconsistent in order to determine whether A is acceptable.

Since the eigenvalue of the n-order uniform matrix is n, the n-order positive reciprocal matrix A is a uniform matrix if and only if it has the

largest eigenvalue $\lambda_{\max} = n$, And when the positive reciprocal matrix A is non-uniform, there must be $\lambda_{\max} > n$.

Therefore, the consistency check steps are as follows:

- 1、 Calculate consistency indicators *CI*

$$CI = \frac{\lambda_{\max} - n}{n - 1}$$

- 2、 Find the corresponding average random consistency indicator RI. For n=1, 2,...,9, The value of R was found in the data, as shown in the following table:

n	1	2	3	4	5	6	7	8	9
RI	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45

The value of RI is obtained by constructing 500 sample matrices by random method: randomly extracting digital constructive positive reciprocal matrices from 1~9 and its reciprocal, and obtaining the average of the largest eigenvalues.

$$\lambda'_{\max}, \text{ and define: } RI = \frac{\lambda'_{\max} - n}{n - 1}$$

- 3、 Calculate the consistency ratio:

$$CR = \frac{CI}{RI}$$

When $CR < 10$, It is considered that the consistency of the judgment matrix is acceptable, otherwise the judgment matrix should be appropriately modified.

- 4、 The results of the total ranking of the solution are as follows:

Table 4:Result of hierarchical total sorting

Guidelines	Appropriate number of times	Wonderful look	Simple arrangement	Reasonable ranking	Total sort weight
Criteria layer weight	0.4733	0.1627	0.0681	0.2959	
plan 1	0.2857	0.5396	0.5396	0.1634	0.3081
plan 2	0.1429	0.1634	0.2970	0.2970	0.2023
plan 3	0.5714	0.2970	0.1634	0.5396	0.4896

As can be seen from the total weight of the table, the optimal scheme 3.

5. The impact of final results on Coca-Cola's

FIFA rankings

By querying relevant information, it can be seen that FIFA's ranking is based on the implemen-

tation of the points system, and the points rules for one match are:

$$P = M \times I \times T \times C$$

Among them:

1) M is the game score: win 3 draws and 1 lose 0, the team won by penalty shootout 2 points, the loser 1 point.

2) I is the competition coefficient: 1 for the friendly match; 2.5 for the World Cup and the Continent Championships; 3 for the Continent Championships and Confederations Cup; 4.

3) T is the opponent coefficient: (200 - opponent ranking) / 100, if the opponent ranks below 150, directly use 0.5 as the coefficient.

4) C is the regional coefficient (the regional coefficient of a match is the average of the regional values of both parties):

South American Football Association (CONMEBOL) 1.00

European Football Association Federation (UEFA) 0.99

Asian Football Federation (AFC) 0.85

African Football Association (CAF) 0.85

Oceania Football Federation (OFC) 0.85

Central and Central America and Caribbean Football Association (CONCACAF) 0.85

As the final result of the game is accumulated between the previous wins and losses, and each game's victory will have points accumulated, the higher the score of the final result of the team, the more points accumulated in the team, the corresponding The more likely the FIFA rankings will rise or the higher the ranking. The following is a quantitative calculation of the model to describe the cumulative increment and ranking impact of the points in the Football Association rankings when the participating teams get the corresponding rankings in the previous established system.

The accumulated cumulative increment is:

$$P_z = \sum_{i=1}^6 P_i$$

Among them, P_z is the total score obtained by the team after the end of all competitions, P_i is the accumulated points for each stage.

$$P_i = \sum_{j=1}^n M_j \times I \times T_j \times C_j$$

(1) The scores for each match in each stage are as follows:

$$M_j = \sum_{r=1}^3 p_r q_r$$

Among them, q_r indicates the corresponding scores that can be obtained in different results, and p_r indicates the probability that the corresponding results can be obtained.

(2) The opponent coefficient for each match in each stage is:

$$T_j = \frac{200-t}{100}$$

Among them, t is the opponent's ranking. By finding relevant information, it is found that among the participating teams in the World Cup, there are very few teams ranked 60 out of the finals, so there are:

$$t = t_j \pm t^*$$

Where t_j is the base opponent coefficient for each stage, and t^* is its corresponding random fluctuation coefficient, which is in the range $(0, 2t_j)$.

(3) The area factor for each match in each stage is:

$$C_j = c + c^*$$

Among them, c is the base coefficient of the stage, c^* is the random fluctuation coefficient, and its value range is $(0, 1-c)$

Due to the different stages that each ranking team can participate in, the final accumulated points are not the same.

6. conclusion

Through the analysis and demonstration above, among the three schemes proposed above, the combination of single knockout round and mul-

tiple knockout round in scheme 3 has the best effect. In the case of scheme 3, the integral model can calculate the result easily and quickly.

The approximate points that can be obtained by using the random simulation of MATLAB can be obtained as follows:

Table 5:General score table for different rankings

1	2	3	4—6	7—12	13—16	17—32	33—48
155	126	95	78	60	42	14	0

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