

## A revised method of deciding the order in a round-robin tournament

Zhizhong Han, Yunnan Physical Education Teacher's College, No. 5-61 Building 20 of Yunnan Sports Committee, Dongfeng Road, Kunming, Yunnan, China

### Abstract

The anticlockwise method is the traditional method used to decide the order of contests in a round-robin tournament and is still in use today. It has many advantages but also a significant drawback. That is, when the number of competing teams is odd the "n-1" team is in an unfavorable position. In order to solve this problem, the writer has created a better system that not only retains the advantages of the traditional order but also overcomes its shortcomings.

*Key words:* round-robin tournament, deciding the order of contest, traditional order, revised rotation method, principle

### 1. Statement of the problem

The anticlockwise method is still in use because it has many advantages, as \*Cheng has listed:

- 1.1 The matches go on round by round, guaranteeing a steady pace of the event.
- 1.2 The most important match, which is most probably to be the final, appears in the last round.
- 1.3 Matches between strong and weak teams are arranged evenly in each round.
- 1.4 The opponents of the strongest team are arranged from weak to strong, giving the most favorable position to the most likely winner.

But there is a significant shortcoming: When the number of teams in the round-robin is odd, from the fourth round on, the "n-1" team is in an unfavorable position, for all of its opponents had a bye in the previous round. This is shown by the following table for 7 teams:

Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7
1 - 0	1 - 7	1 - 6	1 - 5	1 - 4	1 - 3	1 - 2
2 - 7	0 - 6	7 - 5	6 - 4	5 - 3	4 - 2	3 - 0
3 - 6	2 - 5	0 - 4	7 - 3	6 - 2	5 - 0	4 - 7
4 - 5	3 - 4	2 - 3	0 - 2	7 - 0	6 - 7	5 - 6

The writer investigated this shortcoming and found that the gravity of the problem should not be ignored in theory or in reality. For example, in the Chinese second teenagers' sports meeting, in the preliminary contest of team competition there were seven seven-team round-robins. The result was that three No.6 teams out of the seven groups placed last, or 7th, in their groups (here No.6 team is n-1 team, i.e., 7-1 team). One of the reasons that leads to such results is because they are arranged at "n-1"

position. Table tennis is an example but it could just as well be basketball, volleyball, badminton or tennis. Since these sports require more physical strength than table tennis, the problem will be worse.

Therefore, as Cheng pointed out, "a better method should be found through active study".

## 2. The revised method of deciding the order in a round-robin tournament

The writer's objective was to create a new system that retains the advantages of the traditional method but effectively overcomes its shortcoming. This is called the revised method.

### 2.1 Form

2.1.1 The revised method for 7 teams is as follows:

(R:round;L:line)

L \ R	I	II	III	IV	V	VI	VII
1	1-0	4-0	7-0	3-0	6-0	2-0	5-0
2	2-7	5-3	1-6	4-2	7-5	3-1	6-4
3	3-6	6-2	2-5	5-1	1-4	4-7	7-3
4	4-5	7-1	3-4	6-7	2-3	5-6	1-2

2.1.2 When there are 8 teams the table becomes:

L \ R	I	II	III	IV	V	VI	VII
1	1-8	4-8	7-8	3-8	6-8	2-8	5-8
2	2-7	5-3	1-6	4-2	7-5	3-1	6-4
3	3-6	6-2	2-5	5-1	1-4	4-7	7-3
4	4-5	7-1	3-4	6-7	2-3	5-6	1-2

### 2.2 Characteristics:

2.2.1 The matches go on round by round, ensuring steady progress of the event.

2.2.2 The most important game (1-2) is placed in the last round and all matches between the top three teams are placed in the last three rounds. The competition climaxes in the late rounds.

2.2.3 Except for the second round, there are relatively close games in each round. In each round the matches between strong teams and weak teams are rather even. Take 8 teams for example:

example :

L	Method R	REVISED							TRADITIONAL						
		I	II	III	IV	V	VI	VII	I	II	III	IV	V	VI	VII
STRENGTH INDEX DIFFERENCE	1	7	4	1	5	2	6	3	7	6	5	4	3	2	1
	2	5	2	5	2	2	2	2	5	2	2	2	2	2	5
	3	3	4	3	4	3	3	4	3	3	4	4	4	3	3
	4	1	6	1	1	1	1	1	1	1	1	6	1	1	1

16 16 10 12 8 12 10 16 12 12 16 10 8 10

Compare the strength index differences of the two systems; they are completely the same except for the order.

2.2.4 The strongest team faces opponents of gradually increasing strength, favoring the strongest team, which will probably win the championship.

2.2.5 When the competing teams are odd in number, the serious shortcoming of the traditional rotation is effectively overcome: each team will get an even chance to draw a bye. Still using seven teams as an example; there is a steady progression. The order of byes is 1, 4, 7, 3, 6, 2, 5. But note that the team that next plays one of these will itself draw a bye in its subsequent round:

1-0, 7-1, 7-0, 6-7, 6-0, 5-6, 5-0, 4-0, 3-4, 3-0, 2-3, 2-0.

The order of byes are regular: after a team has a game with a bye team it will draw a bye in the next round. The chance of drawing a bye is equal.

2.2.6 When there is an odd number of teams, it is easier to arrange the competition arena because the teams on the first line in each round all have byes, and the times for the teams to be on each line are equal. (Still taking 7 teams for example; each team is on each line twice)

Court \ R	I	II	III	IV	V	VI	VII
(1)	2 — 7	5 — 3	1 — 6	4 — 2	7 — 5	3 — 1	6 — 4
(2)	3 — 6	6 — 2	2 — 5	5 — 1	1 — 4	4 — 7	7 — 3
(3)	4 — 5	7 — 1	3 — 4	6 — 7	2 — 3	5 — 6	1 — 2

2.2.7 So using the revised rotation, everything is clearer and more convenient: arranging the schedule of each round, looking for the order of the match, filling in the results and checking if there are missing games or results. It is efficient for the staff working on the match. For instance, based on the competition arena chart above, add the dates. It is obvious that the matches in each round are distributed regularly on the chart.

	A	B	C	D	E	F	G	SCO RE	PLA CE
A	*	7	6	5	4	3	2		
B	20 8:30 (3)	*	5	4	3	2	1		
C	19 14:30 (1)	19 8:30 (3)	*	3	2	1	7		
D	19 8:30 (2)	18 14:30 (1)	18 8:30 (3)	*	1	7	6		
E	18 14:30 (2)	18 8:30 (2)	17 14:30 (1)	17 8:30 (3)	*	6	5		
F	18 8:30 (1)	17 14:30 (2)	17 8:30 (2)	20 8:30 (1)	19 14:30 (3)	*	4		
G	17 14:30 (3)	17 8:30 (1)	20 8:30 (2)	19 14:30 (2)	19 8:30 (1)	18 14:30 (3)	*		

But look at the following chart, which is arranged according to the traditional rotation. It looks disorganized. Though we have been using the method for a long time, we can't make sure whether everything is correct or not. So, we have to use Cheng's method, using \*a specially constructed board. It is an overelaborate method.

	A	B	C	D	E	F	G	SCORE	PLACE
A	*	7	6	5	4	3	2		
B	20 8:30 (1)	*	3	6	2	5	1		
C	19 8:30 (1)	19 14:30 (2)	*	2	5	1	4		
D	19 8:30 (1)	19 14:30 (2)	17 14:30 (3)	*	1	4	7		
E	18 14:30 (1)	17 14:30 (2)	19 8:30 (2)	17 8:30 (3)	*	7	3		
F	18 8:30 (1)	19 8:30 (3)	17 8:30 (2)	18 14:30 (2)	20 8:30 (3)	*	6		
G	17 14:30 (1)	17 8:30 (1)	18 14:30 (3)	20 8:30 (2)	18 8:30 (2)	19 14:30 (3)	*		

17	date
14.30	time 1 to 7 are rounds
(1)	table number

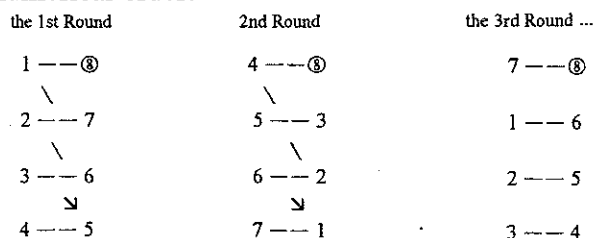
### 2.3 Operating procedure

2.3.1 Arrange the first round as in the traditional method.

2.3.2 Enter the team with the last cardinal number (for an even number of teams) or 0 (for an odd number) in the right-hand place of the first line in every round.

2.3.3 From the second round on, the team on the first line in the left-hand place of the previous round is moved to the right-hand place of the last line.

2.3.4 Starting with that team and joining the fixed position (2.3.2) anticlockwise entering the teams in numerical order:



### 3. The principle of the revised rotation

In order to find this best method, the writer analyzed many other currently used methods. This study shows that that Backer's method and the fixed zero method overcome the shortcomings of the traditional method but at the same time lose some of its advantages. Here is Backer's table for 7 teams:

L \ R	I	II	III	IV	V	VI	VII
1	1-0	0-5	2-0	0-6	3-0	0-7	4-0
2	2-7	6-4	3-1	7-5	4-2	1-6	5-3
3	3-6	7-3	4-7	1-4	5-1	2-5	6-2
4	4-5	1-2	5-6	2-3	6-7	3-4	7-1

As this chart shows that the competition does not climax in the later rounds.

Operating procedure: The first round is the same with the traditional method; the bye, "team 0", is always on the first line at the right in odd rounds and at the left in even. To arrange the next round, move the team in right-hand place of the last line to the first line and match it with "0"; then, use the anticlockwise rotation to fill in the other teams. Then do the other rounds similarly. It is a complicated system to operate.

L \ R	I	II	III	IV	V	VI	VII
1	1-0	7-0	6-0	5-0	4-0	3-0	2-0
2	2-7	1-6	7-5	6-4	5-3	4-2	3-1
3	3-6	2-5	1-4	7-3	6-2	5-1	4-7
4	4-5	3-4	2-3	1-2	7-1	6-7	5-6

Shortcomings: the games between strong teams are not regularly distributed and there is no climax in the later rounds of the match.

Operating procedure: fix "0" in the right-hand place of the first line and then use the anticlockwise rotation to arrange the next round's match. It's easy to operate. Besides the two methods discussed above, a new method can always be derived by setting a different number and moving in the anticlockwise direction. All the charts formed in this manner can be listed by computer, and compared with the revised standard. This kind of optimization and comparison is rather complicated. Experience often shows that when a problem can't be solved by a conventional thought, unconventional thought will solve it. The revised method created by the writer is the unconventional mode of thinking and is a revision of Backer's method.

3.1 Backer's method is characterized by an even distribution of byes and it is the key to overcoming the shortcoming of the traditional method. It is therefore chosen as the basis of the revised method.

3.2 Whereas Backer lifting the team in right-hand place of the last line into lowering the team in left-hand place of the first line to the right-hand place of the last line. This is the key change to Backer's method:

the 1st Round	(the 2nd Round)	the 2nd Round			the 1st Round	the 2nd Round ...	
1 --- 0	0	5	0 --- 5		1 --- 0	4 --- 0	
	↑	↙			↘		
2 --- 7		6	4	6 --- 4		2 --- 7	5 --- 3
		↓	↑		↘		
3 --- 6		7	3	7 --- 3		3 --- 6	6 --- 2
		↓	↑		↘		
4 --- 5	1 →	2	1 --- 2		4 --- 5	7 --- 1	

3.3 Moving the 0 in Backer's method is overelaborate and has no significance; it is easier and more convenient to fix the 0.

3.4 The result is the best possible system.

\* Cheng jiyian (secretary, ITTF tech. cttee), Table Tennis World, 1984, 3.

\*\* Cheng jiyian "Study of Competition Methods in Table Tennis"