A study of the CYX-94 Computer Draw System for table tennis championships

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Abstract

This paper discusses the function and organization of the "CYX- 94 Computer Draw System." The technical features of CYX-94 are revealed by analyzing data obtained by the system. The CYX- 94 Computer Draw System is based on "A study of competition methods for table tennis" by Cheng Jiayan. It has been successfully used in the 12th ATTC in 1994 and in the 43rd WTTC in 1995. The CYX-94 Computer Draw System was written by FOXPRO.

Key words: computer system, draw, table tennis

1. Foreword

In many events of sports, all athletes compete for speed, distance and weight for better positions and results by improvement of time and space and it depends mainly on the conditions of the athletes themselves. In such a contest, various parameters of time and space may be measured to gain a specific, objective and accurate figure by tools or instruments. The objective of the struggle by the players is the objective parameter which has no difference in speed, distance or weight.

But, in a game which involves direct confrontation between two persons, it is totally a different case as mentioned above. Especially, in the case of elimination, if there are 128 players taking part in men's singles, one will become the champion by winning over seven opponents successively. It means that he has won all other players in singles.The winning or defeat in table tennis depends mostly on the players' high technique, and may be partly affected by other factors such as the style of play, the strong (or weak) points of players or the property of the racket. One who is highly skill may defeat most of the players,but may lose to a certain players because of the latter's style of play, whose strong point or whose racket dose not quite suit him. If this player with high skill meets the one for whom he does not suit, he will be defeated and will lose his place and even be eliminated at the very beginning. In fact, there are usually a group of the finest players in the world championships or national tournaments with the best level in skill, equal in skill and without advantages over one another, and each could be the eventual champion. Table tennis is basically a competition between two single players (even in team competition it is the aggregate of all the individual games). It is all the more important to the table tennis players than any other sports in team competition to depend on suitability of play, adaptability of racket, taking advantage of our strong points to overcome

opponent's weakness. Factors like concentration and mental approach, comparing to game like Basketball, Volleyball or Football, play a more significant role in table tennis.

Thus,when elimination system is adopted in table tennis tournaments, the fixture arranged at the very beginning will, to a certain extent, affect the results. The same group of players in a different order of fixture may get the total different results, at times with great disparity owing to the fact that chance plays a more significant role in elimination system. If elimination system is used as a means of trials or a method of examination of performance, its results are unreliable. Therefore in order to make elimination, a practical method of tournament, not only a certain number of "seeded" players must be set to make up the weakness of irrationalization, but also certain measures must be taken to avoid human error of subjective element and to prevent influence of chance element caused by lack of scientific or unreasonable application. This measure of using chance against chance is called "the draw". It is a very complicated skill. Chinese Cheng's Self-help Manual Draw System has been shown to work well in several World Championships, World Cups and Olympic Games. In order to enable more people to master it, to fit it for development by modern science and technology, and to solve some problems in the current method, we developed the CYX-94 Computer Draw System. We thank the late ITTF president Mr. Ichiro Ogimura, the Chairman of the ITTF Technical Committee Mr. Yap Yong Yih and his committee for their energetic support and help. This system fully showed its advantages in the 12th ATTC and in the 43rd WTTC.

2. Results and discussion

2.1 The theory of draw

The draw is a very complicated skill and therefore we must fully understand the theory of draw first before we can do it well. 2.1.1 Adopting the method of "draw" to use the element of chance to prevent occurrence of chances to ensure that the opportunities of each and every player are equal and fair.

In the case of a draw, if it is only to ensure that each player taking part in elimination will get the same chance; then, it is a very simple job as a player will definitely get a position he deserves. When there is no restriction among players, it is very easy to do so. But in table tennis, there are some predetermined condition to restrict the draw in the knock out tournaments. First, it is that Seeding by Ranking in accordance with the provisions of 3.5.2 in the Regulations for International competition. Second, it is that Seeding by Association Nomination in accordance with the provisions of 3.5.3 in the Regulations for International competition. These two basic requirements for the draw indicate that the results of any draw are not arbitrary or unconditioned but relatively accurate. By using the method of "chances" we are able not only to ensure the opportunity of each player is equal; but also by using the method of "control" to make sure of relative accuracy so as to make elimination system more rational. As such, if we were to use the method of chance freely without any control, it cannot cater for needs for a fair draw. Besides the method of "chance", some measures of "control" has to be applied. Of course, it has to be applied in a right way, too much control will render the draw meaningless.

The responsibility of a draw is to resolve the contradictions between "chance" and "control" correctly.

2.1.2 Adoption of the two principles, "Foresight" and "Differentiation" as the efficient, scientific way to resolve the contradictions between "Chance" and "Control"in the Draw.

2.1.2.1 The Principle of Foresight

Once the number of positions in elimination tournament is decided, the number of players to be allotted in different regions (the upper and lower regions, each 1/4 region; each 1/8 region, etc.) would be fixed and equally distributed in principle (except when the remainder will be unevenly distributed). In the case when draw is uncontrolled, the lots would be cast freely to allow players to enter any regions and as such it will not ensure that players from the same association, who are drawn later, would meet at last stage and be separated according to their ranking into different regions respectively. But, if there is too much control, draw will be irrational and meaningless.

In order to solve this problem, the principle of foresight must be carried out first. The general process and results (not specific positions) would have been predicted when the draw is made. As such, we may do something about the control, i.e. to minimize the range and the "objects" of our control would be those players expected to be in the last round according to their ranking. Furthermore, we must provide that no matter what the order for the draw is, the chances are generally equal for every unit. Although admittedly, there are still some element of chances in their control, yet it is at least not artificially fixed.

2.1.2.2 The principle of differentiation

Since draw is a form of chances, it seems to be contradictory that the result of the draw is required to be predictable, i.e., to have the foresight. The principle of differentiation is, therefore, the method adopted to resolve the contradiction between "chances" and "control". The principle of foresight mentioned above is based on the principle of differentiation.

Among all the players taking part in the competition, we have to separate the seeded players from non-seeded, to identify the seeded players with different ranking order and to differentiate all the non-seeded players. All in all, we must differentiate all the players taking part in the competition. Based on this principle of differentiation, we will be able to regulate and to rectify the contradiction between "chances" and "control".

Take singles event as an example, in the competition, the number of players of each unit may be 5,4,3,2, or 1, and also may be 6 or 7 etc. The basic requirement in the draw for drawing the players from the same unit into different regions is that Seeding by Association Nomination in accordance with the provisions of 3. 5. 3 in the Regulations for International competition.

Because of the different number of players in each unit, we can actually form four types of teams. Teams with 4,8 players are called "o team"; the teams with 3,7 players:"L team"; the teams with 2,6 players as "m team" and the team with 1,5 players as "n team".

From here, it is noted that there are two distinct types of players in these four different types of teams; one is the type where number of players is the multiple of four in one team. They must be, on an average, draw into 1/4 each region (if, there are four players, each one is put into each 1/4 region: if eight, two of them into each 1/4 region, etc.). In draw for singles event, according to the method that the region is divided by four quarters, (each quarter as a unit), the positions of these players in each 1/4 region may be "reserved". In this case, the regions for this group of players through the draw need not use any control, but are drawn into completely. We called this group of players the "R-

type". The other type is those teams whose number of players is not the multiple of 4. They will be drawn into different 1/4 regions (based on the rule of one player in each quarter). If there are enough number kept in reserve in each region either in quarters or in halves, the draw for these regions may be made completely "by chance".If however, the number kept in reserve in some of the regions are limited it becomes necessary, to "control" the draw to this region. We call this group of players, "S-type".Therefore, the types of the team depend on the number of the players in each team.

No. of players	Type of team	Type of player	
		R	S
1	n		1
2	m		2
3	L		3
4	o	4	
5	n	4	1
6	m	4	2
7	L	4	3
8	o	8	

2.1.3 The disadvantages of depending too much on chances in elimination method may be completely overcome by the two principles of foresight and differentiation ㄋ、to resolves the contradiction between "chance" and "control".

The principles of foresight and differentiation are based on the basic requirement of draw. Based on these two principles, we may now properly resolve the contradiction between "chance " and "control" in draw. Not only it fulfills the requirement of the two basic principles as prescribed by the Regulations of International Competitions(that the seeded players must be reasonably separated according to their ranking and meet at the final stage; and that the players from the same team must be reasonable separated according to the ranking order arranged by their own team and meet at the last stage) but also it avoids the awkward situation of confusion and incompetency or to avoid the situation that after the draw it becomes necessary to rectify the mistakes contrary to the two basic principles or even necessitate to abandon the draw. At the same time, it will avoid making senseless redraw(partly or completely) in order to meet the requirement of the two basic principles as prescribed by the Regulations of International Championships or be accused that the Draw is controlled irrationally, arbitrary, and inequality in chances.

For the convenience of discussion, let us set aside the problem of drawing lots for the seeded players. Let us, first take all the players in the competition as non- seeded players into different regions and then determine their positions. "Division into different regions" is to ensure that as a matter of principles only one player of each team (or at most two players in some teams) is allotted into each region. Based on this principle of "determination of the position" of each player is easy. As far as "division into different regions" and "determination of the position " are concerned, the former is more difficult. The key of success in the draw depends on how to divide the regions and the principles of foresight and differentiation are there to resolve its contradiction.

Now supposing that there are 57 players of 12 teams in men's singles in elimination, the number of players of each team is as follows:

Name of team	A	B	C	D	E	F	G	H	I	J	K	L
No. of players (persons)	8	7	7	6	6	5	5	4	3	3	2	1

Take 64 positions to arrange the orders in competition, the seven positions of byes are:Nos.2,63,34,31,18,47 and 50. Besides the one bye in the first quarter, there are two positions of byes in the other three quarters.

The first step: to divide players into different regions.

First of all, based on the number of players of each participating team, the type of each team may be defined as: A and H as "o" team; B,C, I and J as "L" team; D,E, and K as "m" team; F,G and L as "n" team. After that, take out all the "R-type" players from the "L","m","n" teams; (there are also four players each in teams B,C,D,E,F and G who are also "R-type".)

The "R-type" players must be drawn into each quarter on average so that the vacant positions have to be kept in advance, that is to say that the number of players that have to be fixed into each quarter are called the "fixed numbers". The "R" players are indicated with sign "O" in a small appropriate ruled line in the "Table of Controlling Players into Different Regions" Therefore, there are eight "R" players in teams A-two in each quarter; four "R"players in teams B,C,D,E,F,G and H - one in each quarter. There are thirty-six"R" players in eight teams - A,B,C,D,E,F,G and H. It's necessary to leave nine fixed numbers in each quarter in advance - from the very beginning of draw. The fixed numbers may not be used until the lots of the "R" players of each team are drawn. Thus, the "chance" of the "R" players are ensured and do not need any "control". Even if the lot is drawn at the last place, his chance is just the same.

Region		No. of players in each team	1/4 Region			
1/2	1/4	A B C D E F G H I J K L 8 7 7 6 6 5 5 4 3 3 2 1	No. of position	No. of byes	Fixed No.	No. in reserve
1	1	○ ○○○○○○○○	16	1	9	6
	2	○ ○○○○○○○○	16	2	9	5
2	3	○ ○○○○○○○○	16	2	9	5
	4	○ ○○○○○○○○	16	2	9	5

The number of position in each quarter minus the number of byes of the same quarter and then minus the fixed number of the "R" players, the balance would be the number reserved for the "S" players of each team. By using the symbol "●" as the "S" players and place it on the border lines between quarters or halves. As such the "S" players of "L"team are respectively placed on the border lines at between the 1st and 2nd quarters at between the 3rd and the 4th quarters and at between the upper region and the lower region - one on each line; of "m" team, at between the 1st and 2nd quarter, and at

between the 3rd and the 4th quarters - one on each line; of "n" team, only between the upper region and lower region.

Region 1/2	1/4	No.of players in each team A B C D E F G H I J K L 8 7 7 6 6 5 5 4 3 3 2 1 3 3 2 2 1 1 3 3 2 1	1/4 Region No. of position	No. of Byes	Fixed No.	No. in reserve	1/2Region No. of position	No. of Byes	Fixed No.	No. in reserve
1	1	●●●● ●●●	16	1	9	6	32	3	25 (18+7)	4
	2	●● ●● ●● ●	16	2	9	5				
2	3	●●●● ●●●	16	2	9	5	32	4	25 (18+7)	3
	4		16	2	9	5				

Then, we must make provision to the "R" players drawn on the ruled line of each quarter and the "S" players drawn on each border line. For all the "R" players, their placement to quarter or half are the fixed and therefore sufficient vacant positions must be kept in advance. As such, in drawing the lots of the "R" players it does not bother with the numbers kept in reserve in each quarter and half. The lots of "R" players may be freely cast into any quarter and need not be "controlled". This reflects the spirit of "chance" perfectly. Hence, it does not matter who is drawn first or later as it does not restrict one another in the draw. [In this example, there are 36 "R" players among 57(about 63%); who are not "controlled". In each quarter, there are 9 fixed numbers for the 36"R" players. In upper region and the lower region, 18 fixed numbers are therefore held respectively. The number of byes and the fixed numbers are equal to the numbers kept in reserve in each quarter or half.]

There are three different cases of the 21 "S" players: in the first case, three "S" players in "L" team may be drawn into three quarters respectively. At least one "S" player should be drawn into the upper region and the other into the lower region. For this type of case there is only one fixed number in one half. In the second case, two "S" players in "m" team can be drawn into any quarter of either the upper or the lower regions respectively. It means there is only one fixed number in one half; and in the third case, one "S" players in "n" team can be drawn into any quarter or half. It comes under the number to be kept in reserve in any half or quarter. There are 7 fixed numbers for 4 "L" teams and 3 "m" teams in each upper region and lower region. Thus, the fixed number of "R" players, altogether in the upper and the lower regions, is eighteen; for "S" players seven and twenty-five in total. The number to be kept in reserve in the upper half region will be: 32 -3-(18+7)=4, and in the lower half region 32-4-(18+7)=3. When the lots of the "S" players are drawn, if the number kept in reserve in the quarter with two "S" players already drawn from "L" team, one has to be substreacted. After the "S" player of the 3rd place is drawn, the numbers kept in reserve in the quarter and the half where the 3rd placed player is in, one has to be subtracted. When the lots of two "S" players of "m" team are drawn, the number kept in reserve in the quarter concerned, subtract "one" from the number. And after the "S" players of "n" team are drawn, the numbers kept in reserve for the quarter and the half concerned each has to subtract "one".To certain extent, in the case, when the numbers kept in reserve in each quarter and each half become difficult to

divide these "S" players into different regions because of those remaining number, control has to be exercised so that the two players from the same unit may be drawn in advance into two different 1/8 regions within the same quarter, so that the rest may be drawn freely into each position.

In general, control of draw is only exercised to a few of "S" players as they normally occupy higher ranking order and as such control becomes more reasonable.

Based on the principles of "Differentiation" and "Foresight",it is possible to fulfill the basic requirement on the control of division into regions to ensure its compliance with the 2 basic rules of International Competition Regulations, at the same time it gives the players the maximum benefit of the chance in the draw; avoiding control; which is only exercised when unavoidable. We should avoid control blindly and willfully or doing it purely for the sake of control. On completion of the division of players into regions, it is found that some of the units are left with 2 players in the same quarter and some with only 1 player. In this case, only draw the 2 players into different 1/8 region of the same quarter and the rest into any region. Here, we can disregard the difference of "R" or "S" players. If there are too many vacant positions in the same quarter, for the teams with 2 players; we can divide all teams with 2 players into 2 separate 1/8 regions in advance so as to avoid having 2 players in the same 1/8 region and then make the draw to determine their positions.

2.1.4 The mathematical demonstration on the theory of "the control of draw for dividing players into different regions"

We can classify teams taking part in competition into four categories:"o" team, "L" team, "m" team and "n" team. Based on the number of the "R-type" and the "S-type" players, we can make provision to control the division of regions. As such we shall notice:

For "o" team, there will be no problem in drawing one or two players into each quarter.

For "n" team, there is also no problem to draw the extra one player into any quarter.

For "m" team, one of the two players or the extra two can be drawn into any quarter in the upper half region, and the other in the lower half region. As it does not interfere with one another, again there is no problem.

But, for "L" team, on the surface it may seem to us, that there will be no problem for the 1st and 2nd players of the three or the extra three to enter into any of the quarter in the upper and the lower half region, and for the 3rd to enter into anyone of the remaining two quarters. In fact, it is not that simple as it is much more complicated. Drawing lot of the 3rd player is restricted by the positions of the 1st and 2nd players of the same unit as he cannot be drawn to enter into each quarter freely. He has to be drawn into the other two quarters where the 1st and 2nd players are not drawn.Thus comparing with the 1st player of "n" team (or the 5th one), the 3rd player of "L" team has a different special characteristic although, as it appears, both of them are drawn on the border lines between the upper and the lower half regions. If this special characteristic is not regarded, the control of division of players into different regions by draw may fail.

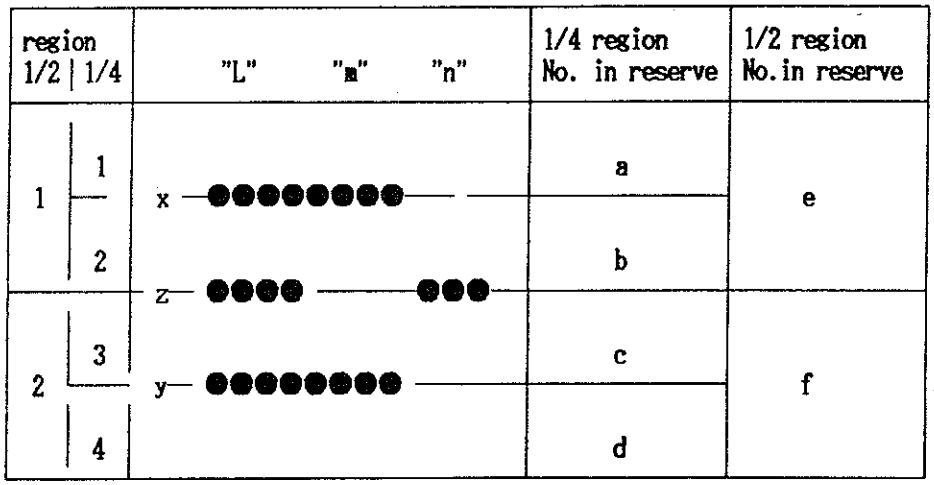
Because of that, when the "S-type" players are divided into two groups, "blocking up" in the draw will occur. In order to make absolutely sure that the draw for dividing the regions will be successful, it is necessary for us to study deeper into the problem and to come up with a mathematics demonstration so as to solve the theoretic problems in draw thoroughly. In the case of "o" team it deals entirely with fixed number and nothing to do

with the number kept in reserve, therefore, it can be left out. For easy clarification, we shall only study the problems of the mathematical theory on the control of dividing players into different regions by draw affecting the teams"n", "m" and "L".

Suppose: a,b,c,d are respectively the numbers kept in reserve of the 1st, 2nd, 3rd and 4th regions, e, f are the number kept in reserve in the upper and the lower half regions each; there is "L" number kept in reserve in "L" team; "m" in "m" team and "n" in "n" team;

line x, y are the border liners of two 1/4 regions of the upper and the lower half regions respectively;

line z is the border line of the upper and the lower half regions.



Based on the calculation on the number kept in reserve as mentioned above, the number of players kept in reserve for the upper half is the sum of the numbers kept in reserve of the two quarters; a+b; and it also includes some of the players entering the upper half among the players dotted on line x and line z. Therefore, the number kept in reserve in the Upper Half a+b is equal to number of players on x line (L+m) and the addition of number kept in reserve in Upper Half e. Then:

a+b=L+m+e

the number of players on line x L+m=a+b-e

Similarly, on line y L+m=c+d-f

L+m=a+b-e=c+d-f (1)

on line z L+n=e+f (2)

Theorem A: If there is no "L" team (L= 0) and use the method mentioned above to carry on the control of dividing players into the different regions, no "blocking-up" case will occur. Draw must be successful.

Proof:

We know that according to the principles of "foresight" and "differentiation", draw should not fail at the very beginning. There is always one possibility of success (at least one possibility). Our duty in the "control" of the draw is to sustain this possibility from beginning to the end and if this possibility is kept alive, it is unnecessary to control. It is when this possibility is demolished, that the control will be applied in order to accomplish the draw completely.

When L=0,

Formula(1) will change to: m=a+b-e=c+d-f

Formula(2) will change to: n=e+f

Because there is no "L" team, there are left with only two cases - team "m" and team "n":

if one team "m" is draw, then

Formula (1) : m=a+b-e

will change into m-1=(a-1)+b-e(when drawn into region a)

or m-1=a+(b-1)-e(when drawn into region b)

m-1=a+b-e-1

Because after one team "m" is drawn, m turns into m'= m-1, the number kept in reserve a+b turns into a'+b'=a+b-1 and e does not change. Then the formula mentioned above changes into:

m'=a'+b'-e

It is agreed to the original formula, and then draw must be kept going on.

Similarly m=c+d-f

turns into m-1=(c-1)+d-f(when drawn into region c)

or m-1=c+(d-1)-f(when drawn into region d)

m-1=c+d-f-1

Because after one team "m" is drawn, m turns into m'=m-1, the number kept in reserve c+d turns into c'+d'=c+d-1 and e does not change. Then the formula mentioned above turns into:

m'=c'+d'-f

It is agreed to the original formula, and then draw may still be kept going on.

Formula(2) n=e+f no change (drawing team "m" has nothing to do with n).

if one team "n" is drawn, then

Formula(1) m=a+b-e

changes into m=(a-1)+b-(e-1)

=a+b-e-1+1

=a+b-e

It stands still (Drawing team "n" has nothing to do with m. if team "n" is drawn into region 'a', the number 'a' kept in reserve has to subtract one. So as 'e' in the upper half region).

or m=a+(b-1)-(e-1)

=a+b-e-1+1

=a+b-e

It stands still

Similarly m=c+d-f

changes into m=(c-1)+d-(f-1)

=c+d-f

or m=c+(d-1)-(f-1)

=c+d-f

It stands still.

Formula(2) n=e+f

changes into n-1=(e-1)+f(when drawn into the upper half region)

=e+f-1

or n-1=e+(f-1)(when drawn into the lower half region)

=e+f-1

Because after one team "n" is drawn, n turns into n'= n-1, the number e+f kept in reserve turns into e'+f'=e+f-1. Then the formula mentioned above turns into

n'=e'+f'

It is agreed to the original formula. So draw may be still kept going on.

As it is, whether one team "n" or one team "m" is drawn, formulas(1) and (2) stand still. 0=0 must be turned into at last, so no "blocking -up".

Theorem B: If there are L teams "L", M teams "m" and n teams "n",the necessary condition to be successful in draw is:

L<=min(a,b,e)+min(e,d,f) (3)

Note: min(a,b,e)indicates the minimum number among a,b,e. For example, min(3,1,5) is 1, so does min(c,d,f)

Proof:Necessity is proved first

(Disproof) If L>min(a,b,e)+min(c,d,f), there are at most min(a,b,e) teams from which the 3rd players may enter the upper half region (because it is dealt with the numbers a,b,e kept in reserve), and min(c,d,f) teams, the lower half region (because of dealing with c,d,f). The total is less than L teams. Evidently, the draw fails. That is why condition (3) is needed. Sufficiency is proved now. From Formula(3): L>min(a,b,e) +min(c,d,f) according to formula(3), L is divided into two parts; L1 and L2

L= L1+L2

and L1<=min(a,b,e)

L2<=min(c,d,f)

Suppose a=L1+a1

b=L1+b1

e=L1+e1

c=L2+c1

d=L2+d1

f=L2+f1

from formula(1) L+m=a+b-e

L1+L2+m =L1+a1+L1+b1-(L1+e1)

=L1+a1+b1-e1

m+L2 =a1+b1-e1 (4)

similarly L+m=c+d-f

L1+l2+m=L2+c1+L2+d1-(L2+f1)

=L2+c1+d1-f1

m+L1 =c1+d1-f1 (5)

We draw L1 teams "L" into the upper half region (that is, among L1 teams "L", two players of each team enter into the upper half region, one into the lower half region), and L2 teams "L" into the lower half region (that is, among L2 teams "L", two players of each team enter into the lower half region, one into the upper half region). When the draw for L=L1+L2 is finished, the remainder of the numbers a+b kept in reserve in the upper region, then, is still:

a+b-2L1-L2

but a=L1+a1

b=L1+b1

c=L2+c1

d=L2+d1

the remainder of the numbers kept in reserve in the upper half region.

a+b-2L1-L2
=(L1+a1)+(L1+b1)-2L1-L2
=a1+b1-L2

Similarly, the remainder of the numbers c+d kept in reserve in the lower region, then, is still

c+d-2L2-L1
=(L2+c1)+(L2+d1)-2L2-L1
=c1+d1-L1

from formula(4), the numbers kept in reserve in the upper and the lower half regions are known as:

a1+b1-L2=m+e1>m
c1+d1-L1=m+f1>m

And so m teams "m" may be drawn into.

After the draw for m teams "m" are finished, the remainder of the numbers kept in reserve in the upper half regions is :

a1+b1-L1-m=e1

The remainder of the numbers kept in reserve in the lower half regions is:

c1+d1-L1-m=f1

from formula (2)

L+n=e+f
n=e+f-L
=L1+e1+L2+f1-L
=e1+f1+(L1+L2)-L
=e1+f1

n teams "n" are drawn into properly.

Here sufficiency is proven.

Therefore, if formula(3): L<=min(a,b,e)+min(c,d,f) is maintained during drawing lots now and then, it is made sure that no "blocking-up" will occur and draw should be successful, which would not be affected by the order of drawing lots.

2.1.5 The correct method of control based on the mathematical theory of the control of dividing players into different regions.

The correct method of control by drawing lots for teams "n","m" and "L" will be discussed one by one.

2.1.5.1 Draw for team "n"

If it is drawn into the upper half region, a,b,e will turn into a-1,b,e-1 or a,b-1,e-1, that is, min(a,b,e) turns into min(a-1,b,e-1)or min (a,b-1,e-1); zero or one may be substracted from its value. Why not two to be substracted from it? Because from the forms a-1,b,e-1, it seems that there are two "1" substracted. But from min(a,b,e), though there are two numbers substracted among three numbers a,b,e, at most only one may be substracted from min(a,b,e), too.

If team "n" is drawn into the lower half region, c,d,f will turn into c-1,d,f-1 or c,d-1,f-1, that is, min(c,d,f) turns into min(c-1,d,f-1) or min(c,d-1,f-1). Similarly, zero or one may be substracted from its value.

Now, in the inequality L<=min(a,b,e)+min(c,d,f), the left side is not substracted but 1 or 0 may be substracted from the right side (because on one player in team "n" may be drawn into one half region). Therefore, if left<right originally, the draw for team "n" need not control; if left=right, it needs control. When drawing lots, the value on the right

side does not decrease, i.e. it cannot be drawn into 1/4 region or 1/2 region where there is the minimum of a,b,e or c,d,f.

2.1.5.2 Draw for Team "m" type

The two players of team "m" must be drawn into any 1/4 region of the upper and lower half regions respectively.

If one player enters into the upper half region, 1 has to be substracted from the value of a or b. If one player enters into the lower half region, another 1 must be substracted from the value c or d. The draw for team "m" has nothing to do with e and f.

If one player is drawn into the upper half region, there are three cases possible:

(i) In(a,b,e), if the minimum is e, the value of min(a,b,e) doesn't decrease.

(ii) In(a,b,e), if the minimum is the number a or b kept in reserve in 1/4 region (not in the same 1/4 region where the player is drawn in), the value of min(a,b,e) does not decrease also.

(iii) In case when the player is drawn in the 1/4 region which is the region where the minimum is min(a,b,e) and then 1 must be substracted from the value of min(a,b,e). When the other player is drawn into the lower half region, it is the same.

In the case of min(a,b,e)+min(c,d,f), they may be three possibilities also-0,1 or 2 may be substracted from the value. While drawing lots for team "m", the value on the left side is not decreased. Then if originally right>=left+2, it is unnecessary to control the draw for team "m"; if originally right=left+1, it is necessary to control the right side on which at most, only one team - min(a,b,e) or min(c,d,f) may subtract one; if originally right=left, it is necessary to control the value on the right side so as not to decrease.

2.1.5.3 Team "L" type is drawn.

If the 3rd player of team "L" is drawn into the upper half region where one of the 1st or the 2nd player is already drawn in, 1 should be substracted from the three values a,b,e each, and only 1, must be substracted from min(a,b,e). In the meantime, if there is a player drawn into the lower half region, 1 is substracted from the value c or d, the value f does not change, and 0 or 1 may be substracted from min(c,d,f)

If the 3rd player of team "L" is drawn into the lower half region where one of the 1st or 2nd player is already drawn in; only one is to be substracted from the three values c,d,f each. In the meantime, if there is a player drawn into the upper half region, one is substracted from the value a or b; the value e does not change, and 0 or 1 may be substracted from min(a,b,e).

When team "L" is drawn, 1 is substracted from the left side of L<min(a,b,e) +min(c,d,f) and 1 or 2 from the right side. If originally right>left, it is unnecessary to control the draw for team "L"; If originally right=left, it is necessary to control the right side from which 1 must be substracted and while one has to be substracted from the number kept in reserve in the half region where the 3rd player is drawn in. Only the number in the left region where only one player is drawn into does not decrease, as it cannot be drawn into the 1/4 region where the minimum of (a,b,e) or (c,d,f) is in.

We may conclude the three cases of teams "n","m" and "L" mentioned above as follows:

When right >=left+2, it is unnecessary to control the draw for any teams;

When right=left+1, it is unnecessary to control the draw for teams "n" and "L", and if team "m" is drawn, 2 cannot be substracted on the right side, that is, one cannot be substracted at the same time from the minimum number flexible in the upper and the lower regions, i e., the upper and the lower regions cannot be drawn as the minimum

regions at the same time.

When right=left, nothing can be substracted from team "n"(a,b,e) and (c,d,f), i.e., team "n" may not be drawn into 1/4 region or 1/2 region where the minimum of (a,b,e) or (c,d,f) is in; When team "m" is drawn, nothing should also be substracted from a,b,c and d, i.e., team "m" should not be drawn into the 1/4 region where the minimum of a,b, or c,d is in;when team "L" is drawn, maximum of one may be substracted on the right side i.e., if there is only one player in any 1/2 region, that player should not be drawn into a 1/4 region where the minimum of (a,b,e) or (c,d,f) is in.

Simple to say:

min(a,b,e)+min(c,d,f)=L+2, no need to control;

min(a,b,e)+min(c,d,f)=L+1 team "m" needs control;

min(a,b,e)+min(c,d,f)=L, teams "n","m" and "L" all need control;

min(a,b,e)+min(c,d,f)<L, "blocking-up" would occur and the draw is considered failure.

2.2 The technical features of the system

2.2.1 The draw is highly successful

We must have the confidence to comply with two basic rules under the Regulations for International Competitions on the separation of seeded players from same Association according to ranking so that they do not meet until the final stage. The system put the draw in firm footing. During the draw, no error should appear, no redraw is permissible; nor to allow the mistake to occur so as to force a redraw; nor using man-made allocation of position so as to comply with the two basic rules stated above.

It must be followed that human control over the draw must be minimum while freedom in the draw must be ensured to be at the maximum.

If human control is done to the minimum, then the restriction in the control will be in area when some of lower-ranking players are to be drawn. The opportunity for every team basically must be the same, freely and non-manipulative. Whatever control is applied, it must fulfill the two basic Regulations of the International Competitions with minimum control, reasonable and necessary. It should not be done intentionally and willfully just to meet the requirements of the Regulations.

2.2.2 With scientific method to keep trustworthy

High precise project system is prerequisite for open draw, computer mouse provides self-help draw for participants so that they can master their own fate. During the draw, inner operation of the computer will be shown on the big screen and description will be given. The participants will find that it is a trustworthy system.

2.2.3 With effective measures to realize high speed of the draw

This system realized high speed of drawing preparation, conducting the draw and distributing the draw results. The draw of 7 events can be finished within 3 hours.

2.2.4 With convenient operation to work

This system has serial menu and menu prompt. It is easy for user to master the operation.

2.2.5 With dialogue between man and computer to choose computer language. So it is a universal system for different matches.

2.2.6 With warning function to indicate error and explain how to correct. The user can immediately find and correct the error.

3. Conclusion

3.1 This system resolved the contradiction between chance and control, so that it realized equal and maximum chance for every participants and comply with ITTF regulations with necessary control.

3.2 This system has been approved to be a reliable, scientific, practical, universal and trustworthy draw system.