# Block Tie-Breaking

## *The Need*

Frequently the requirement exists at the end of the block stage of a tournament to tie-break between two or more players within a block, or across blocks, when deciding who will proceed to the knock-out phase. It is not always practical (time or location-wise) to consider play-offs, as are done in the WCF World Championships. Hence, the need exists to determine *"the best"* player(s) to proceed.

The ACA method employing net points is not accepted as an optimal solution for selecting the player(s) to go through within a block. Where we wish to discriminate between players across different blocks it is even less satisfactory. Cases where one block has fewer players, where not everyone has played each other, or where the distribution of ranking grades is skewed, are three such examples.

The ACA wished to determine if a method can be used to permit comparison of the individual performances across blocks to select players for knock-out play which can also be used within blocks.

## *Block Performance Rating*

Louis Nel (Canada) has investigated possible tie-breaking methods and presented a suitable method for consideration to the ACA Executive in August 2006. That paper is contained as an Attachment to this document. The Excel workbooks he refers to are not included but can be provided electronically.

In this method the Block Performance Rating (BPR) of a player can be regarded as their performance level based on wins and losses within the block play. It is independent of scores and peeling, and uses the familiar Normal Probability distribution (as used in the world ranking system) for calculation of win/loss probabilities.

The method determines a number (the BPR) that can be used to compare a player's performance with others. The higher the BPR the better the performance. It is an iterative method which can use either World Ranking Grades or Index values.

The method is succinctly and clearing outlined in the attached paper. An example of the method is also given therein.

## Practicality of Use

Determination of a player's BPR is not trivial, as will be seen from the attached paper. The method described in the paper using Excel spreadsheets is somewhat cumbersome. To be of practical use in ACA tournaments a self-contained program would need to be developed to permit a tournament manager to make use of it. Such a program could easily be incorporated in those already being used at national tournaments.

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**Block Performance Rating as Tie Breaker Method**

by Louis Nel

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Consider a tournament in which there are 10 blocks of 8 players each, from which 32 players are to qualify for the Knock-Out stage. Typically, the top 3 from each block advances to fill the first 30 places, while the remaining 2 players need to be selected from the top remaining contenders from all the blocks. Rank positions in each block is based on the number of games won. Ties often result that have to be broken. The selection of the remaining two players needs to be done in a manner perceived to be fairly based on the merit of their performance in the block play. That is problematic. The BPR method herewith introduced offers a solution both for tie breaking within the block and for comparison of players across the blocks. As reasonable alternative to play-offs, it could save time and costs.

**Description of the method**

It is assumed that every player entered the tournament with a known performance level, expressed on the familiar croquet performance scale. Either the Index or the Grade of the player could serve as that performance level. In this discussion we use the Grade. If player A has Grade = GA and player B has Grade = GB, then the Classical Win Probability formula

CWP(GA,GB) = 1/(1 + 10^( (GB – GA)/500 ) )

gives the win probability of A over B.

Let P be a player for which we want to determine a Block Performance Rating (BPR). Assume that P had at least one win and at least one loss – other players are not of any interest here. For the purpose of BPR determination, we ignore any performance data that P had on entry and look only at his win-loss result in block play. We do use the performance data with which all his opponents entered the tournament and proceed as follows.

Choose a Test Rating *x* for player P. It can be a wild guess, but in terms of this *x* and the known Grades of his opponents, we can calculate the Loser's Win Probability for each game played by P. For each such game, define

Weight of the Game = Loser's Win Probability

For the winner, the Weight expresses the resistance he was expected to overcome. Against a very weak opponent, the Loser's Win Probability is minimal; so is the resistance and so is the Weight. Against a strong losing opponent, the resistance is relatively large; so is the Weight. For the loser, the Weight expresses the resistance he was expected to offer. In case of a very weak loser that resistance is minimal, so is the Weight. In case of a strong loser, the resistance is relatively large; so is the Weight.

In case of a losing opponent with Grade = GL and a winning opponent with Grade = GW we have

(Weight of game won by P) = CWP(GL,*x*)
(Weight of game lost by P) = CWP(*x*,GW).

We define for player P with Test Rating *x*

Testsum($x$) = (Sum of Weights of games won) – (Sum of Weights of games lost).

Note that if the Test Rating $x$ is larger than the true performance level of P, then the loser's win probability CWP(GL,$x$) for a game won by P will be smaller than it ought to be and similarly CWP($x$,GW), which gets subtracted, will be larger than it ought to be, so Testsum($x$) will be smaller than it ought to be. Similarly, if $x$ is smaller than it ought to be, then Testsum($x$) will be larger than it ought to be. We define

BPR of player P = that Test Rating $x$ for which Testsum($x$) = 0.

(It can be shown on the basis of mathematical analysis that such $x$ exists and is unique).

So the BPR of a player can be regarded as the performance level reflected by the wins and losses actually achieved by the player against the opponents with performance levels as given.

At the bottom of the Blocks sheet of the sample document (BPR tutorial.xls) we give a comparison of the 4th place finishers over the 8 blocks. This is to illustrate how this method could be used to determine the two wild cards mentioned at the beginning.
The sample considered deals with only 8 blocks, but 10 blocks of 8 is potentially of interest as an alternative to 8 blocks of 10 (280 games vs 360 games).

The mentioned Blocks sheet shows that in case of tie breaking within the same blocks and no comparison across blocks, the tie breaking is always in the opposite order of the Grades of the tied players. So purely for the purpose of determining which 4 players should get out of each block one need not even perform the determination of a BPR for each player, as described in detail below. This shortcut may seem counter-intuitive at first glance, given that the higher Grade points to the stronger player. But it upholds the principle that performance in block play (rather than entry rank) determines admission to the Knock-out round. Of two players tied in a block for the 4th place (say), the one with the lower Grade had to overcome higher odds to get into that tie i.e. he had to perform better in the actual block play.

**Numerical determination of BPR via Excel worksheets.**

Four worksheets are used as described below. The player identities mentioned could be either names or IDcodes. In the sample provided (BPR tutorial.xls) IDcodes are mainly used , but the corresponding names are shown on the first sheet.

**Worksheet 1** (see sheet **Blocks** in the sample) should provide a list of player identities with their Grades. The one in the sample includes a column of BPR's that have been prepared by a dedicated software program -- for convenient reference and discussion here. It will of course not be available in an actual tournament. That is why these instructions are being written. For sorting convenience the dedicated program assigned a nominal BPR of 3000 for players with no losses and a BPR of 0 for players with no wins.

**Worksheet 2** (see sheet **Game Results** in the sample) should provide a list of game results, including a column for winner IDs and a column for loser IDS. The optional column for game numbers is for convenience of the user to keep track of blocks; the game numbers are never used in BPR determination.

**Worksheet 3** ( see sheet **Game Results with Grades** in the sample) is created out of Worksheets 1 and 2 as follows. Make a copy of the Game Results sheet. Then, by using the VLOOKUP command with reference to Worksheet 1, create two additional columns for Winner Grades and Loser

Grades. Then make two copies of the five columns that now exist, putting them to the right on the same sheet, so as to have three parallel sets of five columns each.

Sort the middle group of five columns by the Winner ID column.

Sort the right group of five columns by the Loser ID column.

The sheet should now looks like the one shown in the sample.

**Worksheet 4** (see **BPR Computation** in the sample) is used for the actual BPR determination. It will be clear from Worksheet 1 which players require Tie Breaking. According to sample the sheet Blocks, player with IDcode 2268 is such a player, to serve here as prototypical example.

Find the list of games won by the player on the Game Results with Grades sheet (see it highlighted in the sample). Create a copy of that list on the BPR Computation sheet via the Paste Special > Values command.

Find similarly the list of games lost by the player and create a copy on the BPR Computation sheet, appended to the bottom of the"games won" list. Delete the player's Grade where it appears, so that the game data looks like this:

| W ID | L ID | W Gr | L Gr |
|---|---|---|---|
| 2268 | 1581 | | 2288 |
| 2268 | 1472 | | 1661 |
| 2268 | 1680 | | 1544 |
| 214 | 2268 | 2247 | |
| 1749 | 2268 | 1891 | |
| 2468 | 2268 | 2042 | |
| 2486 | 2268 | 1755 | |

(It is a good idea to delete the player's Grade because it plays no role whatever in the determination of the BPR and so the relevant information becomes highlighted and better recognized).

Expand the above array as follows:

won-lost data:

| W ID | L ID | W Gr | L Gr | Hi Test Rating 2300 Weight | Lo Test Rating 1400 Weight |
|---|---|---|---|---|---|
| 2268 | 1581 | | 2288 | | |
| 2268 | 1472 | | 1661 | | |
| 2268 | 1680 | | 1544 | | |
| 214 | 2268 | 2247 | | | |
| 1749 | 2268 | 1891 | | | |
| 2468 | 2268 | 2042 | | | |
| 2486 | 2268 | 1755 | | | |
| | | | TestSums = | | |

The number 2300 is an instance of a Test Rating x deliberately made too high while 1400 is a Test Rating deliberately made too low. It is important to start with one that is too high and one that is too low.

The next action is a crucial one. If done right, the whole determination is completed as an easy routine; if done wrong, everything falters. The crucial action is to type a formula into the cell with

green highlighting. It should be the formula for the Win Probability of the Loser for the game in question. That is the game won by the player. Their test rating here is 2300, appearing in cell F4 on the sheet and the Grade of the opponent is 2288, appearing in cell E6 on the sheet. It follows that the formula to be typed into F6 (the green cell) should be

=1/(1+10^((F$4-$E6)/500))

Notice the $ sign in F$4 and $E6, which locks the row of 2300 and the column of 2288.
One checks to see if this formula results in a plausible number. Since the loser's Grade of 2288 is slightly below the Test Rating of 2300 used for the player, the loser's Win Probability should be slightly below 0.5. If that is not the number that appears, be warned that a mistake has been made! Such a mistake should be corrected before any further action is taken.

Now use the Edit > Fill > right command to enter the required formula in the cell to the right of the green cell. Then use Edit>Fill>down command to enter the required formulas in the next two rows, so that all the games won by the player are now entered.

The next crucial action is to enter the appropriate formula into the red cell. It is for the first game lost by the player. The test rating is still 2300, as in cell F4 and the opponent Grade is 2247, in cell D9. Since this is a game lost, the formula should start with a negative sign. It follows that the formula should be

=-1/(1+10^(($D9-F$4)/500))

Again check the feasibility of the entry. Here a loser rated at 2300 against a winner rated at 2247 should give a Win Probability slightly above 0.5 and there should be a negative sign in front. If that is not what appears, correct the mistake before proceeding.

Proceed by entering the remaining formulas automatically by using first the Edit>Fill>right command and then the Edit>fill>down.

At this point you should see the following:

**BPR computation of player 2268**

| won-lost data: | | | | Hi Test Rating 2300 Weight | Lo Test Rating 1400 Weight |
|---|---|---|---|---|---|
| W ID | L ID | W Gr | L Gr | | |
| 2268 | 1581 | | 2288 | 0.4862 | 0.9835 |
| 2268 | 1472 | | 1661 | 0.0501 | 0.7689 |
| 2268 | 1680 | | 1544 | 0.0298 | 0.6600 |
| 214 | 2268 | 2247 | | -0.5607 | -0.0198 |
| 1749 | 2268 | 1891 | | -0.8680 | -0.0944 |
| 2468 | 2268 | 2042 | | -0.7664 | -0.0494 |
| 2486 | 2268 | 1755 | | -0.9248 | -0.1632 |
| | | | TestSums = | -2.5539 | 2.0855 |

Notice that the HiX of 2300 gives a negative Testsum and the LoX of 1400 gives a positive Testsum. This puts you off to a good start. You can now proceed by typing in a number smaller than 2300 which still gives a negative Testsum and a number larger than 1400 which still gives a positive Testsum. By trial and error within a small number of trials you ought to reach a negative Testsum and positive Testsum both of which are close to zero. Both of the Test Ratings should round to the same integer, which is the required BPR. Or, when you reach something like

| Hi Test Rating | Lo Test Rating |
|---|---|
| 1831 | 1829 |
| Weight | Weight |
| 0.8913 | 0.8922 |
| 0.3137 | 0.3157 |
| 0.2105 | 0.2121 |
| -0.1283 | -0.1273 |
| -0.4314 | -0.4291 |
| -0.2745 | -0.2727 |
| -0.5866 | -0.5844 |
| -0.0053 | 0.0065 |

the Testsums in the bottom row are close enough to zero to give the conclusion that the midpoint 1830 between the Test Ratings of 1831 and 1829 can serve as BPR for the player.

Never proceed with two Testsums of the same sign – that does not lead anywhere useful.