Agenda for the FIDE Technical Commission
TEC Meeting, Antalya, TUR, October 10, 2017
11:00-13.00
Chairman: Bharat Singh
Secretary: Andrzej Filipowicz

1. Opening by chairman
2. The presentation of final text of the Separate Chapter of the Technical matters be published in the FIDE Handbook & Website.
3. Tie-breaks study – Unplayed games.
4. Chess Evolution Sets prepared by GM A. Naiditsch.
5. Life chess platform for FIDE events prepared by Assim Pereira
   Website to watch live Chess games from FIDE Events. See attached documents.
6. Miscellaneous

Explanation and details

Ad. 3
Proposal of TEC Sub Commission – see attached
3.1. Prof. Anantharam – unplayed games and tie-breaks
3.2. Mr. Roberto Ricca – unplayed games (two texts 2016 and 2017)
3.3. Mr. I. Vereshchagin
3.4. Mr. E. Ucarcus – proposal of the 2014 year

Ad. 5

5.1. Chess eNotation App - This is an idea for an Android App to replace conventional pen and paper while noting down Chess moves in a tournament.

5.2. ChessKast Broadcast App - Android based solution to help tournament organizers broadcast live games from their tournaments

5.3. Live Chess App for FIDE Events - Proposal for a official FIDE Android/iOS App which Chess fans world-wide can use to follow all the action from FIDE chess events.

Live Chess Platform for FIDE Events

Android/iOS Apps & Website to watch live Chess games from FIDE Events

FEATURES

- A **FIDE branded** App (Android & iOS) & Website to watch official FIDE events
- Watch multiple live boards, all in a **Single Screen**!

View of the live games on the Website

- Watch **Live Video** commentary and learn from the experts

- Users can get to know when a new **Tournament Starts**
- No hassles converting between timezones! Users can exactly know the start time of the next round, in **local timezone,** or choose to get notified when round starts!
- Users can share the game position on **Social Media**
- **Analyze** current game with a Chess Engine. Or make own moves on the Analysis board!
- App is personalized for every user who can easily see his favorite player's **Rankings and games!**
- Play through **All Games** from previous rounds or search according to Players, Openings or Results!
- View all **previous FIDE events**
- Download the Tournament games in **PGN format**
- Different **Board Themes** and Settings

TOURNAMENT ADMINISTRATION

- Simple Web interface to **manage tourneys** with **minimal time** to set up a new tournament
- Supports automatically adding latest player ratings and federation information from FIDE database
- **Automated** Tourney standings (can be generated by the Server or fetched from tournament websites and 3rd parties)
- Supports **correcting games** of a given round or tournament details (schedule etc)
- **Download PGN** of all or any particular rounds

VALUE ADD!

- **Server/App automatically scales** based on user load and can support a thousands of live users simultaneously (uses Cloud technology)
- Ability to **send custom messages** to user devices, informing about FIDE updates or any other promotional message
- Ability to display **Sponsor logos**
- **Gather important viewership statistics** and App usages
- **Automatic server alerts** to organizer via email when a round stalls or something goes wrong with the broadcast
- Games **can be embedded** on any FIDE or organizer website
- Can automatically **share the latest Results/Standings and round-start posts** to various social networks
- Can automatically **post engine analysis/evaluation** of the latest positions to various social networks

LICENSE FEES - Two Options

<u>OPTION 1</u>: (One time + Recurring fee)

USD 899 <u>One-time</u> setup fees

+

USD 99 <u>per tournament</u>

(includes Android, iOS Apps & Web Browser, Server & Hosting and critical bug fixes. Does not include cost of registering/maintaining Developer accounts with Google & Apple)

- Service will be hosted on my Cloud server
- Complete FIDE Branding
- Adding new events and maintaining existing events will be done by me

<u>OPTION 2: (One time fee only, no recurring)</u>

In fact **FIDE can even earn some revenue**, if premium content can be made available in collaboration with FIDE and charged to the user or via Chess or 3rd party ads & sponsorship deals.

USD 1099 <u>One-time</u> setup fees.

- Service will be hosted on my Cloud server
- Android, iOS & Web
- Only a subset of the above features will be initially rolled out.
- App & Service will be co-branded with FIDE and my logo
- Revenue share formula & exact features to be discussed later minus the server, hosting & maintenance costs.
- Adding new events and maintaining existing events will be done by me
- Registering Developer accounts with Google/Apple to be done separately.

Please note that all rights to source code and material developed by the me will be my copyright irrespective of the option above.

ABOUT ME

- Developed the official App of Anand Carlsen matches 2013 & 2014
- Co-founder mychessapps.com & NexM Software Pvt Ltd
- 11+ years of Tech industry experience
- Worked with Motorola before starting own Chess business
- Developing Chess apps and solutions on various platforms since 2008!
- Developed other top chess apps like Follow Chess, Analyze This, iChess used by World champions, top GMs and thousands of other chess fans worldwide with more than a million downloads all-together!

Unplayed Games and Tiebreaks

Rathinam Anantharam

It has been a perennial problem for players and arbiters to apply the tiebreaks like Buchholz and Sonneborn Berger, whenever one comes across unplayed games – be it a bye or forfeit. Though Virtual Opponent system is the best one thus far to solve the issue, most of the players and arbiters feel that it is complicated (or refuse to understand?). Some alternatives have been provided already and I am presenting my attempt.

Virtual opponent calculation for unplayed games is based on the assumption that the virtual opponent of the player A who got a bye or walk over in a particular round, will draw against the opponents in remaining rounds. Though it is approximate, we have to admit that it is a drawback in the system. My suggestion is more or less similar to the one made by Mr. Erdem Ucarcus or Mr. Igor. I also believe in calculating the average of the sum of the points actually scored against his opponents. The system eliminates all the assumptions and considers only the reality.

I would like to deviate from Mr. Erdem Ucarcus and Mr. Igor that my calculation does not stop here. The system suggested by them produces good results but the calculations I have done give better results.

Calculation of Buchholz

Instead of just calculating the average score of the opponents of a player A, I have calculated the Buchholz, wherein the average score of the player's opponents in the tournament has been used as the score of the opponent in the round of the unplayed game/bye. Then Buchholz has been calculated and it is called as Sivakasi Buchholz. Overall, it will give the same result as that of Mr. Erdem Ucarcus, but the latter has a slight disadvantage. Based on the above fact, an example calculation is furnished:

Dileep Kumar R (fide id 25014927 and rating 1854) had a forfeit in the first round of the Tamil Nadu State Junior Fide Rated Chess tournament 2016 (http://chess-results.com/tnr230069.aspx?lan=1).

Rd.	SNo.	Name	IRtg	FED	Pts	Res.	C
1	51	Sudhakar K	1182	IND	0	+	b
2	57	Kishore S V	1086	IND	3	1	w
3	7	Adhithya S	2081	IND	6½	1	B
4	3	Sai Vishwesh.C	2281	IND	6	½	W
5	6	Prasannaa.S	2131	IND	6½	0	B
6	9	Manu David Suthandram R	1989	IND	6	½	W
7	5	Gireman Ja	2230	IND	6	½	B
8	11	Tarun V Kanth	1962	IND	6	½	W
9	32	Gokul S	1576	IND	4½	1	B

Sum of the scores of the played opponents = 44.5

Average = 44.5/8 = 5.56

Buchholz calculated using Virtual opponent = 48

Ucarcus Buchholz, calculated using the average of the opponents for the unplayed game = 44.5 + 5.56 = 50.06

There is a difference of 2.06 Buchholz points between the Virtual opponent calculation and Ucarcus Buchholz calculation, which is slightly higher. The reason is that Dileep Kumar has a rating of 1854 and his opponent Sudhakar K in the first round (where the forfeit took place) has a rating of 1182. There are more possibilities that Sudhakar K would not have scored 5.5 points.

In general, a strong player A meets a weaker player B in the first round. B is not likely to score points as that of the average score of A at the end of the tournament.

My suggestion is as follows:

a) If a strong player gets a forfeit in first round (or second round also?) from a weak player of rating difference of 150 (200?) or unrated,

Sivakasi average = Actual average of played opponents – 0.5 (or 1)

As only weak players get bye, the same equation can be applied to players who get bye.

Sivakasi Buchholz = Sum of the scores all players with whom the player had played + Sivakasi average

b) If a weak player gets a forfeit in first round (or second round also?) from a strong player of rating difference of 150 (200?),

Sivakasi average = Actual average of played opponents + 0.5

Naturally, a player with a good Sivakasi Tiebreak score at the end of the tournament would have met stronger opponents in the tournament. Due credit must be given to him for having scored against stronger opponents. The player who got a bye in any round will be relatively weaker.

Sivakasi Buchholz Cut1, Cut 2 etc. can be calculated in the same manner.

Modification to the formula

In Dubai Open 2016, GM Haznedaroglu Kivanc (2473) was absent in the 5^{th} round for the game against GM Sargissan Gabriel (2693). But, he played all the remaining rounds.

Average score of Sargissan's played opponents = 45.0 /8 = 5.63

Actual point scored by Haznedaroglu Kivanc in the tournament = 6

So, it will be better to take his actual score rather than the average score for Buchholz calculations. For SB score, Sivakasi SB may be used.

Therefore, if the player does not play only one round, the actual score of the player who forfeited the game has to be compared with the average score of the opponent. If the actual score is greater than the average score of his opponent in the forfeit round,

Sivakasi average = actual score of the player who forfeited the game

http://chess-results.com/tnr218034.aspx?lan=1

18th Dubai Open 2016 11 - 19 April 2016

Sargissan Gabriel

Player info

Rd.	Bo.	SNo		Name	Rtg	FED	Pts.	Res.
1	3	101		Rogoznikov Andrey	2296	RUS	4.5	w 1
2	2	58	IM	Aryan Chopra	2447	IND	5.5	s ½
3	19	56	GM	Debashis Das	2452	IND	5.5	w 1
4	7	32	GM	Arribas Lopez Angel	2549	ESP	5	s ½
5	8	46	GM	Haznedaroglu Kivanc	2473	TUR	6	w 1K
6	3	25	GM	Yilmaz Mustafa	2594	TUR	6	w ½
7	7	29	GM	Ghosh Diptayan	2562	IND	6	s ½
8	8	37	GM	Stefanova Antoaneta	2507	BUL	6	w 1
9	4	16	GM	Sokolov Ivan	2626	NED	6.5	s ½

Calculation of Sonneborn Berger score

Here, we cannot use the same calculation as the one for Buchholz. The basic approach in my proposal is the same as the principle for calculation for rating change of a player. For an unplayed game (by forfeit), the rating difference *dp* between two players has to be calculated, from which the percentage *p* is determined from the *dp* table.

Sivakasi SB score for the unplayed opponent = average score of played opponents * *p* (for the forfeit round)

SB score of a player who had a forfeit in the tournament = SB score of the played opponents + Sivakasi SB score of the forfeit opponent

This calculation will fairly reflect the correct SB score.

The SB for the unplayed opponent of Dileep Kumar in the first round (example given in Buchholz):

Rating difference *dp* = 1854 – 1182 = 672

p = 0.92 (maximum difference = 400)

Sivakasi SB score for first round = average score of played opponents * p

= 5.56 * 0.92 = 5.12

If a strong player forfeits his game to a weak player, naturally, the weak player will get very low SB value for the unplayed games. In both cases, it is based on the theoretically expected value by the player to have scored in the unplayed game. This is the basic assumption we are making in calculating the rating change for a player, which has not been disputed by anybody.

In case of a bye, we have to make an assumption that $p = 0.5$

The above calculation could not be used for Buchholz. The reason is that it may be applicable to the first half of the tournament. In the second half, a player's opponent will be more or less of equal strength. Hence, $p \cong 0.5$. Then the score of the opponent will be decreased heavily.

Advantages:

- It removes the parity between one player's average calculated for 9 rounds (assuming that the tournament has 9 rounds) and another player's average from 8 or less number of games in the tournament. The drawback in Mr. Ucarcus or Mr. Igor method have been eliminated.
- It is easy to calculate
- Only the points scored against the played opponents are calculated for deciding the ranking and there is no assumption of complicated virtuality.
- Calculation of SB score is highly reasonable.

More examples

Pranesh M (35028600, rating 1744) had a forfeit in the final round of Tamil Nadu State Junior Championship 2016 (http://chess-results.com/tnr230069.aspx?lan=1).

Rd.	SNo.	Name	IRtg	FED	Pts	Res.	C
1	55	Hariharan A C G	1127	IND	3	1	b
2	3	Sai Vishwesh.C	2281	IND	6	0	w
3	44	Abishek A	1357	IND	4½	1	b
4	5	Gireman Ja	2230	IND	6	0	w
5	57	Kishore S V	1086	IND	3	1	b
6	29	Ruban Sanjay M	1635	IND	5	0	w
7	34	Rajashakkthivel K K	1540	IND	5	0	b
8	47	Sathyan P Muthukrishnan	1260	IND	3½	1	w
9	35	Sai Sujan S	1524	IND	4	+	b

Average = 36/8 = 4.5 Average Cut 1 = 33/7 = 4.71

Sivakasi Buchholz = 36 + 4.5 = 40.5 **Sivakasi Buchholz Cut 1 = 33 + 4.71 = 37.71**

Rating difference dp = 1744 - 1524 = 220

p = 0.78 for higher

rated player

Sivakasi SB for the unplayed game = 0.78 * 4.5 = 3.51

http://chess-results.com/tnr218034.aspx?lan=1
18th Dubai Open 2016 11 - 19 April 2016

Player info - Saduakassova Dinara (Rating 2411)

Rd.	Bo.	SNo		Name	Rtg	FED	Pts.	Res.
1	71	168	WCM	Al-Khelaifi Aisha	1736	QAT	2	w 1
2	20	24	GM	Pantsulaia Levan	2604	GEO	6.5	s ½
3	27	32	GM	Arribas Lopez Angel	2549	ESP	5	w 0
4	52	129		Nimmy A.G.	2148	IND	4	s 1
5	29	22	GM	Mchedlishvili Mikheil	2615	GEO	2.5	w 1K
6	20	44	IM	Sanal Vahap	2478	TUR	4.5	w 1
7	9	19	GM	Fier Alexandr	2619	BRA	7	s 0
8	24	49	GM	Deepan Chakkravarthy J.	2466	IND	5.5	w 0
9	41	106		Muthaiah Al	2281	IND	5	s ½

Average score = 39.5/8 = 4.94

Sivakasi Buchholz = 39.5 + 4.94 = 44.44

Rating difference = 2615 – 2411 = 204

p = 0.24 (Saduakassova is lower rated)

Sivakasi SB for 5th round = 4.94 * 0.24

Summary

Sivakasi Buchholz = Sum of the scores all players with whom the player had played + Sivakasi average

Sivakasi average = Actual average score of played opponents

a) If a strong player gets a forfeit in first round (or second round also?) from a weak player of rating difference of 150 (200?) or unrated,

Sivakasi average = Actual average score of played opponents – 0.5 (or 1)

b) If a weak player gets a forfeit in first round (or second round also?) from a strong player of rating difference of 150 (200?),

Sivakasi average = Actual average of played opponents + 0.5

c) If the actual score is of the forfeited player is greater than the average score of his opponent in the forfeit round,

Sivakasi average = actual score of the player who forfeited the game

If necessary, the formulae may be simplified (without formulae given in a), b) and c)), but it will not provide better results.

Sonneborn Berger score

Sivakasi SB score for an unplayed opponent = average score of played opponents * p (for the forfeit round)

Where p is calculated from the dp table, based on the difference in rating of the two opponents in the forfeit round.

In case of a bye, p = 0.5

Looking for the best tie-break

by Roberto Ricca

Introduction

Which is the best tiebreak?

It is a question that often comes up in our sort of specialized circles and no definite answer is known. I'll try to find one in this paper, following the methodology described below.

The first part of the method is **Define a Global Criterion (GC)**. A GC is something that can be used to sort all the players that participated to the tournament, in a way that doesn't necessarily depend on the number of points.

Once that a GC is found, the idea is to compare the standings produced by the GC to the standings produced by any tie-break (TB) under evaluation. The best TB is the one that produces standings that are the least different from the "adjusted" standings produced by the GC. "Adjusted" because a standard TB breaks ties among players with the same number of points. The original GC standings have thus to be re-sorted to take this into account.

Many things are open to discussion here. First of all, the basic idea. Then the GC, the function to evaluate the comparison between the GC and each TB and which kind of tournaments to analyze. And maybe there is something else that is escaping me at the moment.

GC choice

This is probably the main step, because if the GC is not valid, anything that comes from it is invalid at the same time.
I didn't find a single rock-solid GC. I came up with many of them and decided to continue my search as if any one of them could be the GC. I knew that, without a definite GC, I couldn't get definite answers, but I hoped to at least be able to highlight some trends.

Here is the description of the various GC(s) that I computed and evaluated

(1)	**ABSTPR (Absolute Performance by TPR[1])** The idea is an iterative one. Each player starts with the same rating (e.g. 2000). Then for each player, his TPR[1] is computed and is used as his own new starting rating. The process should be repeated until the starting rating and the computed TPR[1] were coincident, but I actually stopped the process when the sum of the squares of the differences between the starting rating and the TPR[1] was higher than the one resulting in the previous step (I checked that nothing substantial was happening after that). The "rating" that each player had at the moment of the stoppage is the value used to compute the GC standings.

[1] **TPR** is defined as the (algebraic) sum of the ARO (average rating of opponents) and a displacement dependent on the percentage of points achieved in the tournament (tables B.02.8.1.a or B.01.1.49 of the FIDE handbook)

(2)	**ABSELO (Absolute Performance by Elo)** Similar idea as before. Each player starts with the same rating. Following that, for each player the expected score is computed (using the rating table defined by FIDE - *see previous note*). Then a new rating is computed taking the difference between the achieved score and the expected score and multiplying it by a fixed value (K=50). Repeat the process until the sum of the squares of the differences between the expected score and the achieved score was higher than the one resulting in the previous step. The "rating" that each player had at that moment is the value used to compute the GC standings.
(3)	**ZERMELO (Zermelo score)** For a description of this criterion, please look at Vega manual www.vegachess.com/tl/tl_files/music_academy/distrib/vega_en.pdf, Appendix Q, pages 80-81). For my computation, I just used the implementation code given to me by Vega's author, Luigi Forlano. Luckily -*but this is a consideration <u>after the fact</u>*- the standings generated by ZERMELO are very similar to the ones generated by ABSELO. As Luigi Forlano told me, this was expected because Elo's formulae are based on Zermelo's ideas.
(4)	**MISPTS (Missing points system)** Another idea of Luigi Forlano: compute a complete round-robin table for the tournament, inferring the missing results by means of the existing ones. For instance if A has beaten B and B has beaten C, the result inferred for A-C is a win for A. It is a win for A even if A-B or B-C ended in a draw. If both games ended in a draw, the inferred result is a draw. The process is repeated in order to progressively include all the missing results. Basically, there is a direct arc between P and Q when P has beaten Q (it is a win-arc) or has drawn with Q (it is a draw-arc). If there is a path between X and Y, X beats Y if one of the arcs of the path is a win-arc, otherwise it is a draw (all arcs are draw-arcs). When there are more paths between X and Y, take the shortest one or, when of equal length, the one involving in the middle the higher rated player (for instance, if A drew with 1 and 1 drew with B, A-B is a draw, even if A beat 2 and 2 beat B). If there is a path between X and Y and one between Y and X, take the shortest one or, when of equal length, take the win path, if just one exists. Otherwise it is a draw. When all the missing results are inserted, the "points" that each player achieved is the value used to compute the GC standings.
(5)	**BRUNO (Bruno Buchholz's original idea)** I read somewhere that the original idea of Bruno Buchholz was not to use the sum of the opponents' scores (SOS) as a tie breaker, but to multiply the SOS by the actual score of the player and get an evaluator for the tournament of the player. That is, for instance: 6.5 points and a 35 SOS is worse than 6.0 points and a 40 SOS. The above product *(multiplied for 100, for graphical reasons)* is the value used to compute the GC standings.

Tournaments

Ideally, only really played tournaments should be used in this evaluation. However, I didn't find an easy way to get them in the big number I was looking for. Therefore, having at my disposal the tournament generator embedded in javafo (JTG), I decided to use simulated tournaments, at least as a starter.

It is possible to input the JTG with the number of players, the number of rounds, the absence rate (forfeit, half point byes) and the players' ratings. Players are then paired following the Dutch system and reasonable results are generated based on the rating of the players *(which makes them **very** reliable, probably more than in real life - an observation that has to be taken into account)* and a bit also on the color (on average, white gets 54% of the points).

In order not to be "disturbed" by considerations about unplayed games, I lowered the absence rate in order not to have any of them. Ratings were fixed for each tournament with values chosen between 2700 and 1650, in order to have an average of 2000 points. Then I generated 5000 tournaments (or more) for each kind of tournament that I desired to test:
(a) 150 players, 10 rounds
(b) 100 players, 9 rounds
(c) 50 players, 6 rounds

(Of course, I can generate tournaments for any configuration - it is just a matter of time, depending on the numbers of players and rounds. (a) took about twelve hours; (b) a little more than five; (c) just three and a half hours).

This way I got my set of tournaments to analyze.

Evaluation function

I was not too sophisticated in searching for an evaluation function. I just used a sort of relative standard deviation (sorry for the poor math terminology). I took the standings produced by a GC and the standings produced by a TB and computed the standard deviation of the TB versus the "adjusted" GC[2]. The compared items were the position of the players in the respective standings, with ties split in the middle - i.e. if three players tied for places 16 thru 18, all of them were put at position 17.
Of course, the lower the standard deviation, the higher the evaluation for the TB versus *that* GC.

Note that I also used the same evaluation tool to compare the various GC among them, just to see whether they produced similar results.

Below there is a report produced for one tournament (out of 5000 of that type). Then I averaged these data for the 5000 tournaments of the same type to get the final evaluation table.

```
Filename: test10009_1017.trf  (players=100; rounds=9)

      GC values       ABSTPR          ABSELO        ZERMELO          MISPTS          BRUNO
  1 [2694] sc=7.5     2670   [2]      3213   [3]  0.190379   [3]      194   [3]     42375   [2]
  2 [2654] sc=7.5     2658   [3]      3247   [2]  0.251675   [2]      195   [2]     41625   [3]
  3 [2574] sc=8.0     2722   [1]      3324   [1]  0.409484   [1]      196   [1]     44000   [1]
  4 [2534] sc=6.5     2427   [7]      2720   [7]  0.000222   [7]      178   [7]     33475   [7]
  5 [2494] sc=6.0     2488   [5]      3021   [5]  0.062348   [5]      192   [5]     33900   [5]
  6 [2474] sc=6.0     2342   [8]      2578   [8]  0.000079   [8]      176   [8]     29400  [12]
  7 [2434] sc=5.5     2182  [22]      2300  [23]  0.000014  [23]      135  [25]     25025  [21]
  8 [2414] sc=6.5     2293  [16]      2418  [18]  0.000028  [19]      157  [14]     30550   [8]
  9 [2374] sc=6.0     2217  [18]      2412  [19]  0.000029  [18]      147  [19]     26400  [18]
```

[2] "Adjusted" GC is defined in the introduction. As a standard TB breaks ties among players with the same number of points, the original GC standings have to be re-sorted to take this into account

10	[2354]	sc=6.5	2325	[9]	2522	[10]	0.000056	[11]	157	[14]	30225	[9]
11	[2324]	sc=6.5	2428	[6]	2749	[6]	0.000309	[6]	179	[6]	33800	[6]
12	[2314]	sc=6.5	2318	[10]	2513	[12]	0.000051	[14]	148	[18]	29575	[10]
13	[2294]	sc=7.0	2496	[4]	3051	[4]	0.084703	[4]	193	[4]	35350	[4]
14	[2284]	sc=6.0	2297	[13]	2492	[15]	0.000048	[15]	163	[10]	28200	[15]
15	[2264]	sc=6.0	2294	[15]	2508	[14]	0.000054	[12]	161	[12]	28200	[15]
16	[2254]	sc=6.5	2286	[17]	2487	[17]	0.000042	[17]	155	[17]	29575	[10]
17	[2234]	sc=5.5	2301	[12]	2509	[13]	0.000054	[13]	163	[10]	28050	[17]
18	[2224]	sc=5.5	2211	[20]	2263	[26]	0.000010	[26]	136	[24]	25300	[20]
19	[2204]	sc=5.0	1992	[48]	1979	[52]	1.87e-06	[51]	91	[57]	20250	[42]
20	[2199]	sc=6.5	2296	[14]	2488	[16]	0.000045	[16]	156	[16]	29250	[13]
21	[2189]	sc=5.5	2145	[26]	2233	[29]	8.73e-06	[30]	128	[30]	24475	[23]
22	[2184]	sc=6.0	2183	[21]	2337	[20]	0.000017	[20]	145	[20]	25500	[19]
23	[2174]	sc=5.5	2077	[40]	2139	[39]	4.94e-06	[39]	139	[23]	22275	[31]
24	[2169]	sc=5.5	2160	[23]	2295	[24]	0.000013	[24]	128	[30]	24475	[23]
25	[2159]	sc=4.5	2021	[46]	2036	[46]	2.57e-06	[47]	107	[45]	18900	[47]
26	[2154]	sc=5.5	2121	[31]	2224	[31]	8.71e-06	[31]	127	[32]	24200	[25]
27	[2144]	sc=4.5	2119	[33]	2145	[38]	5.01e-06	[38]	112	[43]	20700	[41]
28	[2139]	sc=5.5	2131	[29]	2159	[36]	5.37e-06	[36]	117	[41]	23650	[28]
29	[2129]	sc=4.5	2060	[43]	2119	[41]	4.51e-06	[40]	123	[35]	20250	[42]
30	[2124]	sc=4.5	2134	[28]	2168	[35]	5.86e-06	[35]	120	[37]	21600	[37]
31	[2114]	sc=5.5	2096	[36]	2173	[34]	6.21e-06	[34]	128	[30]	21725	[36]
32	[2109]	sc=5.0	2213	[19]	2518	[11]	0.000067	[10]	158	[13]	23750	[27]
33	[2099]	sc=3.5	1966	[54]	1961	[55]	1.59e-06	[55]	100	[48]	15400	[63]
34	[2094]	sc=5.5	2079	[39]	2125	[40]	4.49e-06	[41]	131	[27]	23925	[26]
35	[2084]	sc=5.0	2120	[32]	2229	[30]	9.35e-06	[29]	140	[22]	21500	[39]
36	[2079]	sc=5.0	2149	[25]	2310	[22]	0.000015	[22]	132	[26]	22750	[29]
37	[2069]	sc=4.5	2139	[27]	2249	[27]	9.91e-06	[28]	130	[28]	21600	[37]
38	[2064]	sc=5.0	2095	[37]	2215	[33]	8.44e-06	[32]	115	[42]	21750	[35]
39	[2054]	sc=4.0	1978	[51]	1931	[57]	1.23e-06	[57]	94	[54]	17400	[53]
40	[2049]	sc=4.5	1978	[51]	1982	[50]	1.80e-06	[52]	105	[46]	17775	[51]
41	[2039]	sc=4.5	1871	[66]	1811	[65]	6.01e-07	[65]	80	[63]	15975	[60]
42	[2034]	sc=5.0	2154	[24]	2318	[21]	0.000016	[21]	126	[34]	22500	[30]
43	[2024]	sc=5.5	2062	[42]	2114	[43]	4.24e-06	[43]	99	[50]	22000	[33]
44	[2019]	sc=5.5	2076	[41]	2149	[37]	5.31e-06	[37]	119	[39]	21450	[40]
45	[2009]	sc=5.5	2312	[11]	2563	[9]	0.000071	[9]	168	[9]	29150	[14]
46	[2004]	sc=4.0	1868	[68]	1843	[63]	7.78e-07	[63]	72	[67]	15200	[66]
47	[1994]	sc=5.0	2102	[35]	2283	[25]	0.000013	[25]	143	[21]	22250	[32]
48	[1989]	sc=4.5	2025	[45]	2084	[45]	3.66e-06	[45]	119	[39]	18675	[48]
49	[1979]	sc=5.5	2117	[34]	2220	[32]	8.32e-06	[33]	127	[32]	24750	[22]
50	[1974]	sc=4.0	1872	[64]	1889	[60]	1.10e-06	[59]	86	[58]	15000	[67]
51	[1964]	sc=4.0	2086	[38]	2116	[42]	4.38e-06	[42]	120	[37]	18600	[49]
52	[1959]	sc=4.5	1892	[63]	1723	[70]	3.34e-07	[72]	75	[66]	16425	[56]
53	[1949]	sc=4.0	1932	[59]	1837	[64]	7.72e-07	[64]	85	[59]	15800	[61]
54	[1944]	sc=4.0	1945	[58]	1889	[60]	9.59e-07	[62]	80	[63]	16400	[58]
55	[1934]	sc=5.0	1858	[69]	1665	[76]	2.26e-07	[77]	60	[76]	15250	[65]
56	[1929]	sc=4.0	1771	[78]	1620	[78]	1.86e-07	[78]	55	[78]	13200	[73]
57	[1919]	sc=4.5	2039	[44]	2092	[44]	3.83e-06	[44]	93	[55]	19800	[46]
58	[1914]	sc=5.0	1991	[49]	1972	[53]	1.64e-06	[54]	81	[62]	20000	[44]
59	[1904]	sc=4.0	1964	[55]	2034	[47]	2.77e-06	[46]	110	[44]	16400	[58]
60	[1899]	sc=3.5	1871	[66]	1771	[67]	4.49e-07	[67]	77	[65]	14175	[70]
61	[1889]	sc=4.5	1961	[56]	1966	[54]	1.70e-06	[53]	100	[48]	17325	[54]
62	[1884]	sc=3.5	1920	[60]	1892	[59]	1.05e-06	[60]	99	[50]	14350	[68]
63	[1874]	sc=4.5	1916	[61]	1884	[62]	9.89e-07	[61]	84	[60]	16425	[56]
64	[1869]	sc=5.0	1981	[50]	1980	[51]	1.87e-06	[50]	100	[48]	18500	[50]
65	[1859]	sc=4.0	1857	[70]	1773	[66]	5.00e-07	[66]	67	[69]	13800	[71]
66	[1854]	sc=3.0	1579	[95]	1296	[96]	2.40e-08	[96]	24	[96]	7950	[93]
67	[1846]	sc=4.5	1781	[74]	1602	[81]	1.60e-07	[81]	60	[76]	13725	[72]
68	[1842]	sc=4.5	1971	[53]	2011	[49]	2.26e-06	[49]	98	[52]	17550	[52]
69	[1834]	sc=3.5	1673	[85]	1493	[86]	8.11e-08	[86]	38	[85]	10325	[85]
70	[1830]	sc=4.0	1872	[64]	1763	[68]	4.09e-07	[68]	65	[71]	15400	[63]
71	[1822]	sc=4.0	1796	[72]	1687	[75]	2.66e-07	[75]	47	[81]	14200	[69]
72	[1818]	sc=3.5	1685	[83]	1496	[85]	8.36e-08	[85]	33	[92]	11200	[80]
73	[1810]	sc=5.0	2007	[47]	2026	[48]	2.54e-06	[48]	98	[52]	20000	[44]
74	[1806]	sc=5.0	2126	[30]	2247	[28]	9.92e-06	[27]	123	[35]	22000	[33]
75	[1798]	sc=3.5	1671	[88]	1516	[83]	9.65e-08	[83]	38	[85]	10675	[84]
76	[1794]	sc=2.0	1633	[90]	1409	[91]	4.88e-08	[91]	27	[95]	7200	[96]
77	[1786]	sc=3.0	1672	[87]	1478	[88]	7.31e-08	[88]	36	[88]	9600	[88]
78	[1782]	sc=3.0	1773	[76]	1726	[69]	3.71e-07	[69]	63	[73]	11100	[81]
79	[1774]	sc=4.0	1720	[81]	1611	[79]	1.75e-07	[79]	60	[76]	12200	[78]
80	[1770]	sc=4.5	1959	[57]	1949	[56]	1.55e-06	[56]	93	[55]	16875	[55]
81	[1762]	sc=2.5	1713	[82]	1572	[82]	1.39e-07	[82]	49	[80]	9375	[89]
82	[1758]	sc=3.0	1657	[89]	1429	[90]	5.65e-08	[90]	35	[90]	10050	[86]
83	[1750]	sc=3.5	1775	[75]	1694	[73]	2.97e-07	[73]	61	[74]	12250	[77]
84	[1746]	sc=3.5	1782	[73]	1714	[71]	3.58e-07	[70]	65	[71]	12425	[75]
85	[1738]	sc=3.0	1678	[84]	1510	[84]	9.41e-08	[84]	36	[88]	10050	[86]
86	[1734]	sc=3.5	1806	[71]	1714	[71]	3.46e-07	[71]	71	[68]	12775	[74]
87	[1726]	sc=3.0	1745	[80]	1603	[80]	1.68e-07	[80]	52	[79]	11250	[79]
88	[1722]	sc=4.0	1909	[62]	1904	[58]	1.15e-06	[58]	82	[61]	15800	[61]

89	[1714]	sc=3.0	1772	[77]	1665	[76]	2.47e-07	[76]	44	[82]	11100	[81]
90	[1710]	sc=3.0	1767	[79]	1688	[74]	2.84e-07	[74]	66	[70]	12300	[76]
91	[1702]	sc=2.0	1428	[98]	1073	[98]	5.46e-09	[98]	11	[99]	5400	[98]
92	[1698]	sc=2.0	1605	[94]	1258	[97]	1.77e-08	[97]	40	[83]	6700	[97]
93	[1690]	sc=2.5	1620	[91]	1304	[94]	2.45e-08	[95]	38	[85]	8625	[91]
94	[1686]	sc=2.0	1565	[96]	1356	[92]	3.60e-08	[92]	30	[94]	7300	[95]
95	[1678]	sc=3.0	1619	[92]	1350	[93]	3.30e-08	[93]	36	[88]	9000	[90]
96	[1674]	sc=2.5	1523	[97]	1299	[95]	2.49e-08	[94]	21	[97]	7625	[94]
97	[1666]	sc=0.5	1219	[100]	839	[100]	1.20e-09	[100]	7	[100]	1350	[100]
98	[1662]	sc=2.5	1611	[93]	1454	[89]	6.74e-08	[89]	31	[93]	8375	[92]
99	[1654]	sc=3.5	1673	[85]	1484	[87]	7.84e-08	[87]	34	[91]	10850	[83]
100	[1650]	sc=1.5	1395	[99]	1070	[99]	4.96e-09	[99]	12	[98]	4125	[99]

Global	ABSTPR	ABSELO	ZERMELO	MISPTS	BRUNO
ABSTPR	null	3.2588	3.5228	5.6767	4.4034
ABSELO	3.2588	null	0.6745	4.8580	5.5893
ZERMELO	3.5228	0.6745	null	4.9249	5.8348
MISPTS	5.6767	4.8580	4.9249	null	7.0972
BRUNO	4.4034	5.5893	5.8348	7.0972	null

TieBreak	ABSTPR	ABSELO	ZERMELO	MISPTS	BRUNO
APRO	0.9220	1.3153	1.3583	1.9558	1.2124
ARO	1.6340	1.6401	1.6568	2.3590	1.8330
AROC	1.7349	1.7029	1.7146	2.4627	1.9118
PTPR	1.7479	1.6062	1.6093	2.3270	1.8668
MEDIAN	1.3583	1.2207	1.2490	2.0469	1.0464
BHCUT1	1.1640	1.3285	1.3693	1.9812	0.8246
BH	1.0954	1.3802	1.4213	1.9442	0.0000
PROGRES	1.9570	1.7593	1.7593	2.2528	2.0372
SONNBER	1.6926	1.7578	1.7521	2.1852	1.3210
KOYA	2.3087	2.2814	2.2672	2.4970	2.1048
DE	3.2094	3.2094	3.2109	3.2016	3.2031
BLACKS	4.0817	4.0829	4.0921	4.2006	4.0280
WINS	4.2338	4.1940	4.1952	4.0589	4.2632
RANDOM	4.6497	4.8094	4.8146	4.8559	4.5651
MD_RD	1.3675	1.2570	1.2884	2.0616	1.0296
B1_RD	1.2329	1.3856	1.4283	1.9975	0.9165
BH_RD	1.0630	1.3229	1.3638	1.9209	0.2236
DE_RD	4.4609	4.5420	4.5541	4.6819	4.3105
MD_OP_RD	1.3115	1.1747	1.2083	1.9824	1.0000
MD_OR_RD	1.3711	1.2410	1.2728	2.0421	1.0630
MD_OC_RD	1.3711	1.2410	1.2728	2.0421	1.0630
MD_PT_RD	1.3711	1.2410	1.2728	2.0421	1.0630
B1_OP_RD	1.1000	1.2728	1.3115	1.9596	0.7874
B1_OR_RD	1.1576	1.3491	1.3856	2.0100	0.8485
B1_OC_RD	1.1705	1.3928	1.4283	2.0298	0.8660
B1_PT_RD	1.1402	1.3266	1.3638	1.9925	0.8307
BH_OP_RD	1.0909	1.4142	1.4560	1.9621	0.2236
BH_OR_RD	1.1358	1.3856	1.4283	1.9672	0.2236
BH_OC_RD	1.1358	1.3856	1.4283	1.9672	0.2236
BH_PT_RD	1.1446	1.4000	1.4422	1.9774	0.2236
DE_MD_OP_RD	1.3115	1.1747	1.2083	1.9824	1.0000
DE_MD_OR_RD	1.3711	1.2410	1.2728	2.0421	1.0630
DE_MD_OC_RD	1.3711	1.2410	1.2728	2.0421	1.0630
DE_MD_PT_RD	1.3711	1.2410	1.2728	2.0421	1.0630
DE_B1_OP_RD	1.1000	1.2728	1.3115	1.9596	0.7874
DE_B1_OR_RD	1.1576	1.3491	1.3856	2.0100	0.8485
DE_B1_OC_RD	1.1705	1.3928	1.4283	2.0298	0.8660
DE_B1_PT_RD	1.1402	1.3266	1.3638	1.9925	0.8307
DE_BH_OP_RD	1.0909	1.4142	1.4560	1.9621	0.2236
DE_BH_OR_RD	1.1358	1.3856	1.4283	1.9672	0.2236
DE_BH_OC_RD	1.1358	1.3856	1.4283	1.9672	0.2236
DE_BH_PT_RD	1.1446	1.4000	1.4422	1.9774	0.2236
MD_PS_BB	1.3416	1.1747	1.2000	2.0224	1.0677
MD_PS_WW	1.3285	1.1683	1.1937	2.0112	1.0488
MD_SB_BB	1.3416	1.1916	1.2166	2.0567	1.0296
MD_SB_WW	1.3416	1.1916	1.2166	2.0567	1.0296
MD_KY_BB	1.3620	1.2510	1.2826	2.0676	1.0440
MD_KY_WW	1.3928	1.2669	1.2981	2.0869	1.0794
B1_PS_BB	1.1225	1.2884	1.3266	1.9824	0.8000
B1_PS_WW	1.1136	1.3038	1.3416	1.9774	0.7874
B1_SB_BB	1.1225	1.2884	1.3266	1.9235	0.7416
B1_SB_WW	1.1225	1.2884	1.3266	1.9235	0.7416
B1_KY_BB	1.1705	1.3248	1.3620	1.9365	0.7746
B1_KY_WW	1.2021	1.3528	1.3892	1.9634	0.8185
BH_PS_BB	1.1091	1.3675	1.4071	1.9468	0.2236
BH_PS_WW	1.1091	1.3675	1.4071	1.9468	0.2236
BH_SB_BB	1.1180	1.3892	1.4283	1.9621	0.2236

BH_SB_WW	1.1180	1.3892	1.4283	1.9621	0.2236
BH_KY_BB	1.1091	1.3748	1.4142	1.9519	0.2236
BH_KY_WW	1.1045	1.3711	1.4107	1.9545	0.2000
DE_MD_PS_BB	1.3416	1.1747	1.2000	2.0224	1.0677
DE_MD_PS_WW	1.3285	1.1683	1.1937	2.0112	1.0488
DE_MD_SB_BB	1.3416	1.1916	1.2166	2.0567	1.0296
DE_MD_SB_WW	1.3416	1.1916	1.2166	2.0567	1.0296
DE_MD_KY_BB	1.3620	1.2510	1.2826	2.0676	1.0440
DE_MD_KY_WW	1.3928	1.2669	1.2981	2.0869	1.0794
DE_B1_PS_BB	1.1225	1.2884	1.3266	1.9824	0.8000
DE_B1_PS_WW	1.1136	1.3038	1.3416	1.9774	0.7874
DE_B1_SB_BB	1.1225	1.2884	1.3266	1.9235	0.7416
DE_B1_SB_WW	1.1225	1.2884	1.3266	1.9235	0.7416
DE_B1_KY_BB	1.1705	1.3248	1.3620	1.9365	0.7746
DE_B1_KY_WW	1.2021	1.3528	1.3892	1.9634	0.8185
DE_BH_PS_BB	1.1091	1.3675	1.4071	1.9468	0.2236
DE_BH_PS_WW	1.1091	1.3675	1.4071	1.9468	0.2236
DE_BH_SB_BB	1.1180	1.3892	1.4283	1.9621	0.2236
DE_BH_SB_WW	1.1180	1.3892	1.4283	1.9621	0.2236
DE_BH_KY_BB	1.1091	1.3748	1.4142	1.9519	0.2236
DE_BH_KY_WW	1.1045	1.3711	1.4107	1.9545	0.2000
MD_DE_PS_BB	1.3711	1.2083	1.2329	2.0494	1.1045
MD_DE_PS_WW	1.3583	1.2021	1.2268	2.0384	1.0863
MD_DE_SB_BB	1.3565	1.2083	1.2329	2.0736	1.0677
MD_DE_SB_WW	1.3565	1.2083	1.2329	2.0736	1.0677
MD_DE_KY_BB	1.3766	1.2669	1.2981	2.0845	1.0817
MD_DE_KY_WW	1.3784	1.2510	1.2826	2.0773	1.0794
B1_DE_PS_BB	1.1091	1.3115	1.3491	1.9900	0.7874
B1_DE_PS_WW	1.1000	1.3266	1.3638	1.9849	0.7746
B1_DE_SB_BB	1.1045	1.2728	1.3115	1.9131	0.7416
B1_DE_SB_WW	1.1045	1.2728	1.3115	1.9131	0.7416
B1_DE_KY_BB	1.1489	1.3229	1.3601	1.9313	0.7714
B1_DE_KY_WW	1.1811	1.3509	1.3874	1.9583	0.8155
BH_DE_PS_BB	1.1091	1.3675	1.4071	1.9468	0.2236
BH_DE_PS_WW	1.1091	1.3675	1.4071	1.9468	0.2236
BH_DE_SB_BB	1.1000	1.3748	1.4142	1.9519	0.2236
BH_DE_SB_WW	1.1000	1.3748	1.4142	1.9519	0.2236
BH_DE_KY_BB	1.0909	1.3601	1.4000	1.9416	0.2236
BH_DE_KY_WW	1.0863	1.3565	1.3964	1.9442	0.2000
MD_PS_DE_BB	1.3416	1.1747	1.2000	2.0224	1.0677
MD_PS_DE_WW	1.3285	1.1683	1.1937	2.0112	1.0488
MD_SB_DE_BB	1.3416	1.1916	1.2166	2.0567	1.0296
MD_SB_DE_WW	1.3416	1.1916	1.2166	2.0567	1.0296
MD_KY_DE_BB	1.3910	1.2826	1.3134	2.0940	1.0817
MD_KY_DE_WW	1.3928	1.2669	1.2981	2.0869	1.0794
B1_PS_DE_BB	1.1225	1.2884	1.3266	1.9824	0.8000
B1_PS_DE_WW	1.1136	1.3038	1.3416	1.9774	0.7874
B1_SB_DE_BB	1.1225	1.2884	1.3266	1.9235	0.7416
B1_SB_DE_WW	1.1225	1.2884	1.3266	1.9235	0.7416
B1_KY_DE_BB	1.2000	1.3675	1.4036	1.9698	0.8216
B1_KY_DE_WW	1.1979	1.3657	1.4018	1.9685	0.8155
BH_PS_DE_BB	1.1091	1.3675	1.4071	1.9468	0.2236
BH_PS_DE_WW	1.1091	1.3675	1.4071	1.9468	0.2236
BH_SB_DE_BB	1.1180	1.3892	1.4283	1.9621	0.2236
BH_SB_DE_WW	1.1180	1.3892	1.4283	1.9621	0.2236
BH_KY_DE_BB	1.1091	1.3748	1.4142	1.9519	0.2236
BH_KY_DE_WW	1.1045	1.3711	1.4107	1.9545	0.2000
COMPLETE	1.1023	1.3172	1.3546	1.9862	0.7778
APRO33	0.6720	1.2700	1.2700	2.4626	1.3380
ARO33	1.4368	1.4811	1.4811	2.6274	1.8095
AROC33	1.6064	1.5240	1.5240	2.7591	1.8448
PTPR33	1.5862	1.4368	1.4368	2.7001	1.7825
MEDIAN33	1.8050	1.7780	1.7780	2.7882	1.3014
BHCUT133	1.5709	1.6704	1.6704	2.5684	1.0626
BH33	1.4536	1.7367	1.7367	2.3245	0.0000
PROGRES33	1.3320	1.3075	1.3075	2.4495	1.9092
SONNBER33	1.9960	2.2469	2.2469	2.5016	1.1846
KOYA33	2.3071	2.5590	2.5590	2.8170	1.5606
DE33	2.9703	2.9703	2.9703	2.9539	2.9621
BLACKS33	3.3263	3.0953	3.0953	3.4873	3.1289
WINS33	3.1186	3.1546	3.1546	3.1212	3.3553
RANDOM33	5.0864	5.0673	5.0673	5.0705	4.9595
MD_RD33	1.7413	1.7413	1.7413	2.7940	1.2247
B1_RD33	1.7039	1.7961	1.7961	2.5965	1.2115
BH_RD33	1.4142	1.7227	1.7227	2.3349	0.2200
DE_RD33	4.0321	4.1891	4.1891	4.5543	3.7048
MD_OP_RD33	1.7039	1.7039	1.7039	2.6640	1.1981
MD_OR_RD33	1.8491	1.8316	1.8316	2.7591	1.3380
MD_OC_RD33	1.8491	1.8316	1.8316	2.7591	1.3380

MD_PT_RD33	1.8491	1.8316	1.8316	2.7591	1.3380
B1_OP_RD33	1.4368	1.6264	1.6264	2.5336	0.9755
B1_OR_RD33	1.5240	1.7039	1.7039	2.6027	1.0999
B1_OC_RD33	1.5240	1.7039	1.7039	2.6027	1.0999
B1_PT_RD33	1.5240	1.7039	1.7039	2.6027	1.0999
BH_OP_RD33	1.4368	1.7598	1.7598	2.3349	0.2200
BH_OR_RD33	1.5027	1.7413	1.7413	2.3349	0.2200
BH_OC_RD33	1.5027	1.7413	1.7413	2.3349	0.2200
BH_PT_RD33	1.5027	1.7413	1.7413	2.3349	0.2200
DE_MD_OP_RD33	1.7039	1.7039	1.7039	2.6640	1.1981
DE_MD_OR_RD33	1.8491	1.8316	1.8316	2.7591	1.3380
DE_MD_OC_RD33	1.8491	1.8316	1.8316	2.7591	1.3380
DE_MD_PT_RD33	1.8491	1.8316	1.8316	2.7591	1.3380
DE_B1_OP_RD33	1.4368	1.6264	1.6264	2.5336	0.9755
DE_B1_OR_RD33	1.5240	1.7039	1.7039	2.6027	1.0999
DE_B1_OC_RD33	1.5240	1.7039	1.7039	2.6027	1.0999
DE_B1_PT_RD33	1.5240	1.7039	1.7039	2.6027	1.0999
DE_BH_OP_RD33	1.4368	1.7598	1.7598	2.3349	0.2200
DE_BH_OR_RD33	1.5027	1.7413	1.7413	2.3349	0.2200
DE_BH_OC_RD33	1.5027	1.7413	1.7413	2.3349	0.2200
DE_BH_PT_RD33	1.5027	1.7413	1.7413	2.3349	0.2200
MD_PS_BB33	1.7598	1.7227	1.7227	2.7120	1.2889
MD_PS_WW33	1.7274	1.7086	1.7086	2.6851	1.2378
MD_SB_BB33	1.7413	1.7413	1.7413	2.7940	1.2247
MD_SB_WW33	1.7413	1.7413	1.7413	2.7940	1.2247
MD_KY_BB33	1.7413	1.7413	1.7413	2.7940	1.2247
MD_KY_WW33	1.8139	1.8139	1.8139	2.8568	1.3259
B1_PS_BB33	1.5027	1.6064	1.6064	2.5841	1.0080
B1_PS_WW33	1.4811	1.6461	1.6461	2.5716	0.9755
B1_SB_BB33	1.5240	1.6264	1.6264	2.4429	0.9419
B1_SB_WW33	1.5240	1.6264	1.6264	2.4429	0.9419
B1_KY_BB33	1.5658	1.7039	1.7039	2.4822	0.9419
B1_KY_WW33	1.6461	1.7780	1.7780	2.5527	1.0701
BH_PS_BB33	1.4591	1.7413	1.7413	2.3486	0.2200
BH_PS_WW33	1.4591	1.7413	1.7413	2.3486	0.2200
BH_SB_BB33	1.4368	1.7598	1.7598	2.3349	0.2200
BH_SB_WW33	1.4368	1.7598	1.7598	2.3349	0.2200
BH_KY_BB33	1.4368	1.7598	1.7598	2.3349	0.2200
BH_KY_WW33	1.4199	1.7367	1.7367	2.3314	0.1796
DE_MD_PS_BB33	1.7598	1.7227	1.7227	2.7120	1.2889
DE_MD_PS_WW33	1.7274	1.7086	1.7086	2.6851	1.2378
DE_MD_SB_BB33	1.7413	1.7413	1.7413	2.7940	1.2247
DE_MD_SB_WW33	1.7413	1.7413	1.7413	2.7940	1.2247
DE_MD_KY_BB33	1.7413	1.7413	1.7413	2.7940	1.2247
DE_MD_KY_WW33	1.8139	1.8139	1.8139	2.8568	1.3259
DE_B1_PS_BB33	1.5027	1.6064	1.6064	2.5841	1.0080
DE_B1_PS_WW33	1.4811	1.6461	1.6461	2.5716	0.9755
DE_B1_SB_BB33	1.5240	1.6264	1.6264	2.4429	0.9419
DE_B1_SB_WW33	1.5240	1.6264	1.6264	2.4429	0.9419
DE_B1_KY_BB33	1.5658	1.7039	1.7039	2.4822	0.9419
DE_B1_KY_WW33	1.6461	1.7780	1.7780	2.5527	1.0701
DE_BH_PS_BB33	1.4591	1.7413	1.7413	2.3486	0.2200
DE_BH_PS_WW33	1.4591	1.7413	1.7413	2.3486	0.2200
DE_BH_SB_BB33	1.4368	1.7598	1.7598	2.3349	0.2200
DE_BH_SB_WW33	1.4368	1.7598	1.7598	2.3349	0.2200
DE_BH_KY_BB33	1.4368	1.7598	1.7598	2.3349	0.2200
DE_BH_KY_WW33	1.4199	1.7367	1.7367	2.3314	0.1796
MD_DE_PS_BB33	1.8316	1.7961	1.7961	2.7766	1.3854
MD_DE_PS_WW33	1.8005	1.7825	1.7825	2.7504	1.3380
MD_DE_SB_BB33	1.8139	1.8139	1.8139	2.8568	1.3259
MD_DE_SB_WW33	1.8139	1.8139	1.8139	2.8568	1.3259
MD_DE_KY_BB33	1.8139	1.8139	1.8139	2.8568	1.3259
MD_DE_KY_WW33	1.8139	1.8139	1.8139	2.8568	1.3259
B1_DE_PS_BB33	1.5027	1.6064	1.6064	2.5841	1.0080
B1_DE_PS_WW33	1.4811	1.6461	1.6461	2.5716	0.9755
B1_DE_SB_BB33	1.5240	1.6264	1.6264	2.4429	0.9419
B1_DE_SB_WW33	1.5240	1.6264	1.6264	2.4429	0.9419
B1_DE_KY_BB33	1.5658	1.7039	1.7039	2.4822	0.9419
B1_DE_KY_WW33	1.6461	1.7780	1.7780	2.5527	1.0701
BH_DE_PS_BB33	1.4591	1.7413	1.7413	2.3486	0.2200
BH_DE_PS_WW33	1.4591	1.7413	1.7413	2.3486	0.2200
BH_DE_SB_BB33	1.4368	1.7598	1.7598	2.3349	0.2200
BH_DE_SB_WW33	1.4368	1.7598	1.7598	2.3349	0.2200
BH_DE_KY_BB33	1.4368	1.7598	1.7598	2.3349	0.2200
BH_DE_KY_WW33	1.4199	1.7367	1.7367	2.3314	0.1796
MD_PS_DE_BB33	1.7598	1.7227	1.7227	2.7120	1.2889
MD_PS_DE_WW33	1.7274	1.7086	1.7086	2.6851	1.2378
MD_SB_DE_BB33	1.7413	1.7413	1.7413	2.7940	1.2247
MD_SB_DE_WW33	1.7413	1.7413	1.7413	2.7940	1.2247

MD_KY_DE_BB33	1.8139	1.8139	1.8139	2.8568	1.3259
MD_KY_DE_WW33	1.8139	1.8139	1.8139	2.8568	1.3259
B1_PS_DE_BB33	1.5027	1.6064	1.6064	2.5841	1.0080
B1_PS_DE_WW33	1.4811	1.6461	1.6461	2.5716	0.9755
B1_SB_DE_BB33	1.5240	1.6264	1.6264	2.4429	0.9419
B1_SB_DE_WW33	1.5240	1.6264	1.6264	2.4429	0.9419
B1_KY_DE_BB33	1.6461	1.7780	1.7780	2.5527	1.0701
B1_KY_DE_WW33	1.6461	1.7780	1.7780	2.5527	1.0701
BH_PS_DE_BB33	1.4591	1.7413	1.7413	2.3486	0.2200
BH_PS_DE_WW33	1.4591	1.7413	1.7413	2.3486	0.2200
BH_SB_DE_BB33	1.4368	1.7598	1.7598	2.3349	0.2200
BH_SB_DE_WW33	1.4368	1.7598	1.7598	2.3349	0.2200
BH_KY_DE_BB33	1.4368	1.7598	1.7598	2.3349	0.2200
BH_KY_DE_WW33	1.4199	1.7367	1.7367	2.3314	0.1796
COMPLETE33	1.4865	1.6214	1.6214	2.5747	0.9837

A little explanation on the acronyms (long version and short) representing the single tie-breaks (some of them very obvious):

BH	BH	Buchholz
BHCUT1	B1	Buchholz Cut-1
MEDIAN	MD	Buchholz Median-1
ARO	OR	Average of opponents' rating
AROC	OC	Average of opponents' rating Cut-1
APRO	OP	Average of opponents' performance (**TPR**[1])
PTPR	OT	PreciseTPR, the rating that a player should have in order to have a rating variation of zero *(it is different by the TPR[1], because it is computed game by game, not using ARO)*
PROGRES	PS	Sum of progressive points
SONNBER	SB	Sonneborn-Berger
KOYA	KY	Koya system (score against players who achieved at least 50% of the points)
DE	DE	Direct encounter (following the handbook definition)
BLACKS	BB	Number of games with black
WINS	WW	Number of wins
RANDOM	RD	Ties are broken by draw of lots *(of course, it is the worse possible criterion, but it is meaningful for a statistical point of view, as a sort of anti-benchmark: values close to random values are not very good values)*
COMPLETE		It is a combination of Direct Encounter, followed by Buchholz Cut 1, then Direct Encounter, then Progressive Score and finally Direct Encounter again.

Then there are the combinations of tie-breaks, each one listed in order of application with the short acronym. For instance **DE_MD_OP_RD** represents Direct Encounter first, **Median Buchholz** second, **APRO** third (the fourth one, RD, is useless). .
These combinations are made using one of the Buchholz tie-breaks (BH, BHCUT1, MEDIAN), one of the rating tie-break (ARO, AROC, APRO, PTPR) (when present: sometimes rating tie-breaks are missing as ratings are deemed unreliable), one of the *result*[3] kind of tie-break (PROGRES, SONNEBORN, KOYA) and then other dubious tie-breaks last (BLACKS, WINS), labeled dubious because their evaluations are the closest to RANDOM which is the standard for a bad tie-break. DirectEncounter (DE) is then added in various positions.

The tie-break identifier may be followed by the number 33. It means that the tie-breaks are evaluated only for players that scored about 67% or more points in the tournament (i.e. top 33% points).

[3] It is called *result* because the results of the single games count in a different way. In rating or buchholz criteria, if X play A and B, as long as X scores 1 point against them, it doesn't matter if he beats A and loses from B or if loses from A and beats B, or if he drew both. In *result* criteria, these differences matter (for sum of progressive points also the *momentum* counts).

GC evaluation cross-table

The following tables show the evaluation of any GC versus all the others:

[150-10]	ABSTPR	ABSELO	ZERMELO	MISPTS	BRUNO
ABSTPR		4.234	4.573	7.427	5.975
ABSELO	4.234		0.845	6.409	7.374
ZERMELO	4.573	0.845		6.398	7.665
MISPTS	7.427	6.409	6.398		9.869
BRUNO	5.975	7.374	7.665	9.869	

[100:09]	ABSTPR	ABSELO	ZERMELO	MISPTS	BRUNO
ABSTPR		3.204	3.475	5.416	4.137
ABSELO	3.204		0.729	4.582	5.111
ZERMELO	3.475	0.729		4.562	5.352
MISPTS	5.416	4.582	4.562		6.909
BRUNO	4.137	5.111	5.352	6.909	

[50:06]	ABSTPR	ABSELO	ZERMELO	MISPTS	BRUNO
ABSTPR		2.872	3.338	4.263	2.759
ABSELO	2.872		1.170	3.248	3.091
ZERMELO	3.338	1.170		3.167	3.615
MISPTS	4.263	3.248	3.167		4.565
BRUNO	2.759	3.091	3.615	4.565	

As I have already said before, ABSELO and ZERMELO produce similar results. As it can be seen, MISPTS and BRUNO produce the ones that are the most different.

Can we infer anything from these tables?

I am under the impression that ZERMELO is a good criterion (others seem more superficial[4]) and, therefore, ABSELO (which can be more easily understood by chess people) should be the GC. But I don't have a definitive answer. MISPTS has some merit too, because it measures data in a different way from the ones we are used to.

Tie-break evaluation table

It seems more interesting to show the evaluation table for the single tie-break, without the combinations (shown later, because they are quite dependent on the single tie-break). Highlighted, for each GC, are the best TB(s) from the standpoints of rating, sum of opponents scores, results and the rest.

[4] ABSTPR depends on the computation of TPR[1], which is computed using averages.
MISPTS depends heavily on some results and when there are surprises, the standings that are generated tend to be wild.
BRUNO seems too simple to be also good!

[150-10]	ABSTPR	ABSELO	ZERMELO	MISPTS	BRUNO
APRO	**1.152**	**1.892**	**1.973**	**2.592**	**1.756**
ARO	**2.187**	**2.285**	**2.324**	**2.848**	**2.340**
AROC	**2.236**	**2.284**	**2.319**	**2.845**	**2.396**
PTPR	**2.449**	**2.246**	**2.265**	**2.847**	**2.552**
MEDIAN	**1.954**	**1.865**	**1.921**	**2.662**	**1.234**
BHCUT1	**1.761**	**1.981**	**2.046**	**2.717**	**0.926**
BH	**1.633**	**2.086**	**2.156**	**2.772**	**0.000**
PROGRES	**2.751**	**2.597**	**2.625**	**3.193**	**2.870**
SONNBER	**3.034**	**3.226**	**3.263**	**3.655**	**2.619**
KOYA	**3.830**	**3.773**	**3.789**	**4.036**	**3.580**
DE	4.674	4.674	4.675	4.671	4.662
BLACKS	**5.272**	**5.274**	**5.275**	**5.266**	**5.267**
WINS	**5.953**	**5.964**	**5.965**	**5.929**	**5.969**
RANDOM	**6.613**	**6.613**	**6.614**	**6.608**	**6.606**
APRO33	**0.656**	**1.121**	**1.179**	**1.560**	**1.015**
ARO33	**1.200**	**1.225**	**1.258**	**1.611**	**1.357**
AROC33	**1.261**	**1.224**	**1.253**	**1.625**	**1.420**
PTPR33	**1.377**	**1.239**	**1.256**	**1.657**	**1.538**
MEDIAN33	**1.143**	**1.219**	**1.264**	**1.638**	**0.738**
BHCUT133	**1.034**	**1.186**	**1.237**	**1.633**	**0.557**
BH33	**0.986**	**1.293**	**1.342**	**1.671**	**0.000**
PROGRES33	**1.377**	**1.430**	**1.463**	**1.796**	**1.470**
SONNBER33	**1.610**	**1.883**	**1.922**	**2.181**	**1.301**
KOYA33	**2.438**	**2.676**	**2.703**	**2.752**	**2.257**
DE33	2.809	2.809	2.810	2.806	2.798
BLACKS33	**3.170**	**3.173**	**3.174**	**3.179**	**3.161**
WINS33	**3.358**	**3.344**	**3.339**	**3.207**	**3.361**
RANDOM33	**3.949**	**3.949**	**3.949**	**3.946**	**3.940**

[100-9]	ABSTPR	ABSELO	ZERMELO	MISPTS	BRUNO
APRO	0.943	1.508	1.575	2.019	1.331
ARO	1.710	1.778	1.812	2.192	1.812
AROC	1.750	1.782	1.812	2.194	1.856
PTPR	1.904	1.752	1.770	2.188	1.966
MEDIAN	1.521	1.428	1.478	2.025	0.996
BHCUT1	1.356	1.521	1.577	2.070	0.749
BH	1.246	1.592	1.653	2.108	0.000
PROGRES	2.086	1.949	1.975	2.378	2.125
SONNBER	2.271	2.401	2.433	2.715	1.970
KOYA	2.832	2.783	2.798	2.967	2.650
DE	3.357	3.358	3.358	3.353	3.344
BLACKS	4.425	4.420	4.419	4.425	4.407
WINS	4.203	4.211	4.212	4.183	4.212
RANDOM	4.741	4.740	4.740	4.738	4.732
APRO33	0.669	1.119	1.180	1.520	0.959
ARO33	1.220	1.229	1.267	1.588	1.331
AROC33	1.281	1.231	1.265	1.598	1.398
PTPR33	1.367	1.228	1.252	1.608	1.483
MEDIAN33	1.135	1.145	1.192	1.561	0.763
BHCUT133	1.005	1.137	1.192	1.562	0.583
BH33	0.938	1.251	1.305	1.609	0.000
PROGRES33	1.422	1.403	1.436	1.754	1.461
SONNBER33	1.571	1.813	1.850	2.086	1.281
KOYA33	2.170	2.363	2.395	2.511	1.980
DE33	2.576	2.576	2.577	2.572	2.564
BLACKS33	3.307	3.306	3.307	3.314	3.284
WINS33	3.042	3.035	3.033	2.935	3.047
RANDOM33	3.628	3.626	3.627	3.617	3.621

[50-6]	ABSTPR	ABSELO	ZERMELO	MISPTS	BRUNO
APRO	**0.905**	**1.373**	**1.486**	**1.712**	**1.033**
ARO	**1.503**	**1.507**	**1.590**	**1.816**	**1.447**
AROC	**1.536**	**1.521**	**1.601**	**1.825**	**1.485**
PTPR	**1.624**	**1.475**	**1.550**	**1.803**	**1.545**
MEDIAN	**1.365**	**1.149**	**1.274**	**1.624**	**0.861**
BHCUT1	**1.195**	**1.231**	**1.357**	**1.661**	**0.659**
BH	**1.047**	**1.259**	**1.389**	**1.675**	**0.000**
PROGRES	**1.719**	**1.469**	**1.535**	**1.780**	**1.536**
SONNBER	**1.664**	**1.745**	**1.821**	**2.005**	**1.409**
KOYA	**1.948**	**1.857**	**1.906**	**2.067**	**1.723**
DE	2.149	2.149	2.149	2.140	2.128
BLACKS	**2.436**	**2.440**	**2.439**	**2.424**	**2.422**
WINS	**2.472**	**2.477**	**2.474**	**2.462**	**2.476**
RANDOM	**3.033**	**3.033**	**3.035**	**3.027**	**3.018**
APRO33	**0.742**	**1.144**	**1.252**	**1.432**	**0.852**
ARO33	**1.228**	**1.194**	**1.279**	**1.464**	**1.197**
AROC33	**1.274**	**1.203**	**1.283**	**1.475**	**1.255**
PTPR33	**1.319**	**1.185**	**1.260**	**1.464**	**1.295**
MEDIAN33	**1.159**	**1.014**	**1.128**	**1.376**	**0.741**
BHCUT133	**0.975**	**0.982**	**1.111**	**1.364**	**0.571**
BH33	**0.884**	**1.093**	**1.210**	**1.416**	**0.000**
PROGRES33	**1.386**	**1.208**	**1.279**	**1.471**	**1.248**
SONNBER33	**1.373**	**1.540**	**1.621**	**1.747**	**1.041**
KOYA33	**1.621**	**1.704**	**1.767**	**1.870**	**1.384**
DE33	1.845	1.845	1.846	1.836	1.826
BLACKS33	**2.066**	**2.069**	**2.070**	**2.059**	**2.050**
WINS33	**2.026**	**2.010**	**1.999**	**1.979**	**2.033**
RANDOM33	**2.586**	**2.591**	**2.590**	**2.584**	**2.576**

Some sparse observations:

(a) Some low values are quite obvious: BH and "adjusted" BRUNO are exactly the same things. Also, APRO, by definition, is a good approximation of ABSPTR.

(b) When comparing the configurations of tie-breaks when all players are considered or just the ones that scores 2/3 of the maximum possible points (or better), it can be seen that there is just one outstanding difference: Buchholz-Median is usually the best *Buchholz* criterion when all players are considered, while Buchholz-Cut-1 is better when the analysis is limited to top scorers. Moreover, Buchholz-Cut-1 is never the worst *Buchholz* criterion, so it is probably the best compromise

(c) BLACKS and WINS are not good absolute criteria (of course) as they score just ahead of RANDOM. It seems that WINS scores better than BLACKS with an odd number of rounds, while with an even number of rounds BLACKS is preferable *(actually, more analysis is needed , if deemed important)*

(d) Koya is not a good criterion for Swiss tournaments *(we already assume that, as Koya is not normally used in Swiss tournaments)*

(e) Sum of Progressive Points (PROGRES) and Sonneborn-Berger (SONNEBORN) are always better than Koya, but PROGRES ranks more often than not ahead and even way ahead of SONNEBORN *(this could be a basis for its reintroduction among the recommended FIDE tie-breaks)*

(f) APRO is the best of the ratings criteria[5], which seems predictable as ARO, AROC and Precise-TPR take into account only pre-tournament values, while in APRO also results of the tournament are somewhat considered
It is not conclusive whether ARO (which is the same as TPR) is better than Precise-TPR.

(g) Direct Encounter is pretty meaningless when considered alone. When it cannot be applied, all players with the same score are considered tied (all of them are placed in the middle of their group)

Regarding the combinations, not all the ones presented in the report will be shown here, only the more meaningful. Some considerations:

(a) **when a rating criterion is present**, no following criteria matter that much, as the rating criterion is usually discriminating (ties are so rare that doesn't really matter how to break them).
So the following tables report only situations where a *Buchholz* criterion comes first and the rating criterion is used to break ties produced by the first criterion. Predictably, we get just a refinement of values seen in the previous tables *(except for BRUNO, which is a special case)*, but the previous considerations are still valid. For instance, if the MEDIAN was the best tie-break for a GC, MD_OP will be the best tie-break for the same GC, as APRO is the best rating tie-break for each GC.

In the following tables, before the evaluations for the combinations, the base value of the tie-break (where internal ties are not broken, i.e. all of them have values in the middle) and the benchmark of a bad tie-break (i.e. random values) are reported.
Highlighted in yellow the best values for a GC (in light yellow values that are worse than the base value).

[150-10]	ABSTPR	ABSELO	ZERMELO	MISPTS	BRUNO
MEDIAN	**1.954**	**1.865**	**1.921**	**2.662**	**1.234**
MD_RD	1.991	1.903	1.959	2.688	1.293
MD_OP_RD	1.836	1.809	1.871	2.626	1.187
MD_OR_RD	1.913	1.838	1.896	2.644	1.260
MD_OC_RD	1.917	1.837	1.894	2.643	1.268
MD_PT_RD	1.938	1.832	1.887	2.643	1.296
BHCUT1	**1.761**	**1.981**	**2.046**	**2.717**	**0.926**
B1_RD	1.798	2.014	2.078	2.741	0.995
B1_OP_RD	1.661	1.937	2.005	2.686	0.936
B1_OR_RD	1.737	1.956	2.021	2.699	0.994
B1_OC_RD	1.741	1.955	2.020	2.698	1.005
B1_PT_RD	1.751	1.941	2.005	2.693	1.005
BH	**1.633**	**2.086**	**2.156**	**2.772**	**0.000**
BH_RD	1.668	2.114	2.183	2.793	0.346
BH_OP_RD	1.547	2.041	2.113	2.740	0.346
BH_OR_RD	1.608	2.053	2.123	2.750	0.346
BH_OC_RD	1.609	2.050	2.120	2.748	0.346
BH_PT_RD	1.619	2.040	2.109	2.744	0.346

[5] In environments, of course, where rating are reliable, as the ones used in the simulation

[100-9]	ABSTPR	ABSELO	ZERMELO	MISPTS	BRUNO
MEDIAN	**1.521**	**1.428**	**1.478**	**2.025**	**0.996**
MD_RD	1.559	1.468	1.517	2.055	1.052
MD_OP_RD	1.430	1.393	1.448	2.005	0.955
MD_OR_RD	1.495	1.414	1.465	2.017	1.024
MD_OC_RD	1.498	1.414	1.464	2.017	1.030
MD_PT_RD	1.516	1.410	1.459	2.016	1.053
BHCUT1	**1.356**	**1.521**	**1.577**	**2.070**	**0.749**
B1_RD	1.394	1.554	1.610	2.096	0.815
B1_OP_RD	1.282	1.495	1.555	2.054	0.759
B1_OR_RD	1.344	1.507	1.564	2.062	0.812
B1_OC_RD	1.347	1.507	1.563	2.061	0.821
B1_PT_RD	1.355	1.495	1.550	2.056	0.819
BH	**1.246**	**1.592**	**1.653**	**2.108**	**0.000**
BH_RD	1.283	1.620	1.680	2.131	0.302
BH_OP_RD	1.184	1.566	1.629	2.092	0.302
BH_OR_RD	1.233	1.571	1.632	2.096	0.302
BH_OC_RD	1.235	1.570	1.631	2.095	0.302
BH_PT_RD	1.242	1.561	1.621	2.091	0.302

[50-6]	ABSTPR	ABSELO	ZERMELO	MISPTS	BRUNO
MEDIAN	**1.365**	**1.149**	**1.274**	**1.624**	**0.861**
MD_RD	1.412	1.203	1.323	1.662	0.931
MD_OP_RD	1.282	1.136	1.269	1.619	0.802
MD_OR_RD	1.350	1.155	1.283	1.633	0.887
MD_OC_RD	1.355	1.156	1.283	1.633	0.893
MD_PT_RD	1.370	1.149	1.275	1.631	0.914
BHCUT1	**1.195**	**1.231**	**1.357**	**1.661**	**0.659**
B1_RD	1.238	1.275	1.397	1.694	0.733
B1_OP_RD	1.138	1.233	1.362	1.665	0.659
B1_OR_RD	1.204	1.236	1.363	1.670	0.724
B1_OC_RD	1.208	1.238	1.364	1.671	0.735
B1_PT_RD	1.212	1.222	1.349	1.662	0.728
BH	**1.047**	**1.259**	**1.389**	**1.675**	**0.000**
BH_RD	1.090	1.295	1.421	1.702	0.294
BH_OP_RD	1.009	1.269	1.399	1.681	0.294
BH_OR_RD	1.062	1.258	1.388	1.681	0.294
BH_OC_RD	1.063	1.257	1.388	1.680	0.294
BH_PT_RD	1.068	1.246	1.377	1.674	0.294

When only top-scorers (i.e. players that got at least 2/3 of the maximum possible points) are involved, the situation is different. In the single tie-break tables, it was already shown that BuchholzCut1 had better marks than BuchholzMedian. Here it is shown that the best criterion that can be paired to BuchholzCut1 is PreciseTPR, which is not computable by hand and therefore it has no practical use (although it would be easy to comprehend). There is no clear second, though. AROC has slight better marks than others, but the *race* is too close to call.
It can be said, however, that APRO loses its preceding edge. It is understandable, though. This simulation is very accurate when dealing with top players, which means that their performances are on average very close to their ratings and, therefore, averaging one set or the other is basically indifferent.
In the real world, such consistency cannot be generally assumed.

[150-10]	ABSTPR	ABSELO	ZERMELO	MISPTS	BRUNO
MEDIAN33	**1.143**	**1.219**	**1.264**	**1.638**	**0.738**
MD_RD33	1.176	1.250	1.294	1.661	0.789
MD_OP_RD33	1.074	1.188	1.237	1.622	0.725
MD_OR_RD33	1.117	1.192	1.239	1.623	0.767
MD_OC_RD33	1.121	1.190	1.237	1.623	0.773
MD_PT_RD33	1.127	1.186	1.232	1.623	0.782
BHCUT133	**1.034**	**1.186**	**1.237**	**1.633**	**0.557**
B1_RD33	1.065	1.212	1.263	1.653	0.614
B1_OP_RD33	0.976	1.165	1.219	1.623	0.570
B1_OR_RD33	1.019	1.166	1.218	1.622	0.613
B1_OC_RD33	1.023	1.164	1.215	1.622	0.621
B1_PT_RD33	1.029	1.159	1.210	1.622	0.630
BH33	**0.986**	**1.293**	**1.342**	**1.671**	**0.000**
BH_RD33	1.015	1.316	1.365	1.689	0.240
BH_OP_RD33	0.937	1.269	1.321	1.658	0.240
BH_OR_RD33	0.971	1.269	1.319	1.658	0.240
BH_OC_RD33	0.973	1.266	1.316	1.658	0.240
BH_PT_RD33	0.975	1.263	1.313	1.658	0.240

[100-9]	ABSTPR	ABSELO	ZERMELO	MISPTS	BRUNO
MEDIAN33	**1.135**	**1.145**	**1.192**	**1.561**	**0.763**
MD_RD33	1.170	1.178	1.224	1.586	0.815
MD_OP_RD33	1.064	1.119	1.170	1.548	0.736
MD_OR_RD33	1.115	1.124	1.173	1.552	0.791
MD_OC_RD33	1.118	1.121	1.170	1.551	0.798
MD_PT_RD33	1.126	1.117	1.166	1.550	0.808
BHCUT133	**1.005**	**1.137**	**1.192**	**1.562**	**0.583**
B1_RD33	1.038	1.166	1.219	1.584	0.638
B1_OP_RD33	0.948	1.120	1.178	1.553	0.587
B1_OR_RD33	0.997	1.121	1.177	1.555	0.636
B1_OC_RD33	1.001	1.119	1.175	1.554	0.645
B1_PT_RD33	1.006	1.115	1.169	1.552	0.652
BH33	**0.938**	**1.251**	**1.305**	**1.609**	**0.000**
BH_RD33	0.971	1.275	1.328	1.628	0.243
BH_OP_RD33	0.892	1.230	1.286	1.599	0.243
BH_OR_RD33	0.929	1.228	1.283	1.598	0.243
BH_OC_RD33	0.930	1.226	1.281	1.597	0.243
BH_PT_RD33	0.932	1.222	1.277	1.596	0.243

[50-6]	ABSTPR	ABSELO	ZERMELO	MISPTS	BRUNO
MEDIAN33	**1.159**	**1.014**	**1.128**	**1.376**	**0.741**
MD_RD33	1.202	1.064	1.174	1.415	0.806
MD_OP_RD33	1.086	1.001	1.122	1.373	0.688
MD_OR_RD33	1.144	1.007	1.124	1.377	0.761
MD_OC_RD33	1.149	1.005	1.122	1.376	0.771
MD_PT_RD33	1.156	1.000	1.117	1.373	0.781
BHCUT133	**0.975**	**0.982**	**1.111**	**1.364**	**0.571**
B1_RD33	1.013	1.026	1.151	1.396	0.633
B1_OP_RD33	0.926	0.993	1.123	1.373	0.570
B1_OR_RD33	0.985	0.986	1.115	1.370	0.633
B1_OC_RD33	0.989	0.984	1.112	1.370	0.644
B1_PT_RD33	0.993	0.977	1.106	1.366	0.647
BH33	**0.884**	**1.093**	**1.210**	**1.416**	**0.000**
BH_RD33	0.922	1.125	1.238	1.442	0.249
BH_OP_RD33	0.853	1.096	1.214	1.421	0.249
BH_OR_RD33	0.896	1.086	1.204	1.418	0.249
BH_OC_RD33	0.896	1.083	1.202	1.417	0.249
BH_PT_RD33	0.898	1.078	1.197	1.413	0.249

(b) **when rating criteria are not involved** (because they are deemed unreliable), the side criterion (PROGRES, SONNEBORN or KOYA) is of course important, but it is not going to change what we saw with the main tables. When PROGRES is the best of the *result* GC-group, any combination of *buchholz + progressive* nets better results for that GC. When SONNEBORN is the best (many few instances), any combination of *buchholz + sonneborn* nets better results for that GC.
WINS and BLACKS are not used as side criteria, as they predictably get worse evaluation than the others.

Here are the relative tables:

[150-10]	ABSTPR	ABSELO	ZERMELO	MISPTS	BRUNO
MEDIAN	**1.954**	**1.865**	**1.921**	**2.662**	**1.234**
MD_RD	1.991	1.903	1.959	2.688	1.293
MD_PS_BB	1.936	1.834	1.891	2.653	1.278
MD_PS_WW	1.936	1.834	1.892	2.653	1.279
MD_SB_BB	1.969	1.910	1.967	2.697	1.226
MD_SB_WW	1.969	1.911	1.967	2.697	1.225
MD_KY_BB	1.994	1.903	1.958	2.688	1.284
MD_KY_WW	1.996	1.906	1.960	2.689	1.289
BHCUT1	**1.761**	**1.981**	**2.046**	**2.717**	**0.926**
B1_RD	1.798	2.014	2.078	2.741	0.995
B1_PS_BB	1.748	1.947	2.012	2.704	0.984
B1_PS_WW	1.748	1.948	2.013	2.704	0.985
B1_SB_BB	1.770	2.002	2.067	2.737	0.883
B1_SB_WW	1.770	2.002	2.067	2.737	0.882
B1_KY_BB	1.793	1.999	2.062	2.730	0.962
B1_KY_WW	1.796	2.001	2.064	2.731	0.969
BH	**1.633**	**2.086**	**2.156**	**2.772**	**0.000**
BH_RD	1.668	2.114	2.183	2.793	0.346
BH_PS_BB	1.619	2.048	2.119	2.756	0.335
BH_PS_WW	1.620	2.049	2.119	2.756	0.338
BH_SB_BB	1.682	2.123	2.192	2.805	0.338
BH_SB_WW	1.682	2.124	2.193	2.805	0.340
BH_KY_BB	1.670	2.099	2.168	2.784	0.307
BH_KY_WW	1.672	2.100	2.169	2.784	0.319

[100-09]	ABSTPR	ABSELO	ZERMELO	MISPTS	BRUNO
MEDIAN	**1.521**	**1.428**	**1.478**	**2.025**	**0.996**
MD_RD	1.559	1.468	1.517	2.055	1.052
MD_PS_BB	1.517	1.412	1.463	2.023	1.038
MD_PS_WW	1.516	1.411	1.462	2.022	1.037
MD_SB_BB	1.538	1.471	1.521	2.058	0.996
MD_SB_WW	1.537	1.471	1.521	2.057	0.994
MD_KY_BB	1.562	1.470	1.518	2.053	1.048
MD_KY_WW	1.560	1.468	1.516	2.051	1.046
BHCUT1	**1.356**	**1.521**	**1.577**	**2.070**	**0.749**
B1_RD	1.394	1.554	1.610	2.096	0.815
B1_PS_BB	1.355	1.499	1.556	2.064	0.801
B1_PS_WW	1.355	1.499	1.556	2.063	0.802
B1_SB_BB	1.366	1.539	1.595	2.088	0.716
B1_SB_WW	1.365	1.538	1.595	2.087	0.714
B1_KY_BB	1.388	1.541	1.596	2.085	0.787
B1_KY_WW	1.388	1.539	1.595	2.083	0.787
BH	**1.246**	**1.592**	**1.653**	**2.108**	**0.000**
BH_RD	1.283	1.620	1.680	2.131	0.302
BH_PS_BB	1.246	1.568	1.630	2.099	0.294
BH_PS_WW	1.246	1.568	1.629	2.099	0.293
BH_SB_BB	1.292	1.626	1.686	2.136	0.297
BH_SB_WW	1.292	1.625	1.685	2.136	0.295
BH_KY_BB	1.284	1.607	1.667	2.121	0.279
BH_KY_WW	1.283	1.605	1.665	2.119	0.273

[50-06]	ABSTPR	ABSELO	ZERMELO	MISPTS	BRUNO
MEDIAN	**1.365**	**1.149**	**1.274**	**1.624**	**0.861**
MD_RD	1.412	1.203	1.323	1.662	0.931
MD_PS_BB	1.384	1.146	1.271	1.626	0.905
MD_PS_WW	1.383	1.145	1.270	1.626	0.904
MD_SB_BB	1.370	1.191	1.315	1.656	0.852
MD_SB_WW	1.369	1.191	1.315	1.656	0.850
MD_KY_BB	1.401	1.192	1.314	1.657	0.903
MD_KY_WW	1.399	1.191	1.312	1.656	0.901
BHCUT1	**1.195**	**1.231**	**1.357**	**1.661**	**0.659**
B1_RD	1.238	1.275	1.397	1.694	0.733
B1_PS_BB	1.221	1.217	1.344	1.658	0.705
B1_PS_WW	1.221	1.217	1.344	1.658	0.706
B1_SB_BB	1.197	1.243	1.371	1.677	0.607
B1_SB_WW	1.197	1.242	1.370	1.676	0.605
B1_KY_BB	1.224	1.246	1.371	1.678	0.676
B1_KY_WW	1.223	1.245	1.370	1.677	0.676
BH	**1.047**	**1.259**	**1.389**	**1.675**	**0.000**
BH_RD	1.090	1.295	1.421	1.702	0.294
BH_PS_BB	1.081	1.245	1.376	1.671	0.274
BH_PS_WW	1.081	1.245	1.375	1.671	0.273
BH_SB_BB	1.091	1.293	1.420	1.702	0.277
BH_SB_WW	1.090	1.292	1.420	1.702	0.275
BH_KY_BB	1.090	1.275	1.403	1.692	0.238
BH_KY_WW	1.089	1.273	1.402	1.691	0.237

The tables for top scorers are shortened showing only data when Sum of progressive scores (PS) is used (it is always a better side criterion than the others) and wins (differences with blacks are negligible). The reason for this table is to confirm that, for top scorers, even after the refinement given by PS, BuchholzCut1 has better marks than BuchholzMedian.

[150-10]	ABSTPR	ABSELO	ZERMELO	MISPTS	BRUNO
MEDIAN33	1.143	1.219	1.264	1.638	0.738
MD_PS_WW33	1.128	1.206	1.252	1.635	0.767
BHCUT133	1.034	1.186	1.237	1.633	0.557
B1_PS_WW33	1.024	1.175	1.227	1.630	0.596
BH33	0.986	1.293	1.342	1.671	0.000
BH_PS_WW33	0.980	1.280	1.330	1.667	0.231
[100-09]					
MEDIAN33	1.135	1.145	1.192	1.561	0.763
MD_PS_WW33	1.127	1.134	1.183	1.561	0.792
BHCUT133	1.005	1.137	1.192	1.562	0.583
B1_PS_WW33	1.004	1.127	1.183	1.561	0.619
BH33	0.938	1.251	1.305	1.609	0.000
BH_PS_WW33	0.940	1.237	1.292	1.607	0.233
[50-06]					
MEDIAN33	1.159	1.014	1.128	1.376	0.741
MD_PS_WW33	1.167	1.005	1.120	1.375	0.772
BHCUT133	0.975	0.982	1.111	1.364	0.571
B1_PS_WW33	1.000	0.977	1.106	1.365	0.620
BH33	0.884	1.093	1.210	1.416	0.000
BH_PS_WW33	0.910	1.080	1.198	1.414	0.225

(c) **<u>The impact of Direct Encounter</u>**. The latter may be a popular tie-break, but it is easily foreseeable that it is not a good tie-break, because a good tie-break evaluates a whole tournament while DirectEncounter examines just a very little part of it.
In the list of tie-break it was mentioned COMPLETE, which is an application of DirectEncounter as the first tie-break, followed by Buchholz Cut-1, followed by Direct-Encounter again , then Progressive Score and finally DirectEncounter for a third time. This is the best possible application of DirectEncounter (i.e. at each step of the tie-break ladder). Let's see its marks when compared with B1_PS_WW (in green the values that are an improvement with respect to B1_PS_WW; in red the values that <u>lower</u> the base marks):

[150-10]	ABSTPR	ABSELO	ZERMELO	MISPTS	BRUNO
B1_PS_WW	1.748	1.948	2.013	2.704	0.985
COMPLETE	1.749	**1.947**	**2.012**	2.705	0.986
[100-09]					
B1_PS_WW	1.355	1.499	1.556	2.063	0.802
COMPLETE	1.357	1.499	1.556	2.065	0.804
[50-06]					
B1_PS_WW	1.221	1.217	1.344	1.658	0.706
COMPLETE	**1.220**	**1.215**	**1.342**	1.659	**0.705**
[150-10]	**ABSTPR**	**ABSELO**	**ZERMELO**	**MISPTS**	**BRUNO**
B1_PS_WW33	1.024	1.175	1.227	1.630	0.596
COMPLETE33	1.031	1.178	1.230	1.636	0.607
[100-09]					
B1_PS_WW33	1.004	1.127	1.183	1.561	0.619
COMPLETE33	1.009	1.129	1.184	1.567	0.629
[50-06]					
B1_PS_WW33	1.000	0.977	1.106	1.365	0.620
COMPLETE33	**0.999**	**0.975**	**1.104**	1.367	0.620

Even when applied in the best conditions, if there is any advantage in using the DirectEncounter, it is basically negligible. Here are the tables where the DirectEncounter is applied just once in one specific position:

[150-10]	ABSTPR	ABSELO	ZERMELO	MISPTS	BRUNO
MD_PS_WW	1.936	1.834	1.892	2.653	1.279
DE_MD_PS_WW	1.937	1.835	1.893	2.654	1.281
MD_DE_PS_WW	1.937	1.835	1.892	2.654	1.280
MD_PS_DE_WW	1.936	1.834	1.892	2.653	1.279
B1_PS_WW	1.748	1.948	2.013	2.704	0.985
DE_B1_PS_WW	1.749	1.948	2.013	2.705	0.988
B1_DE_PS_WW	1.749	1.947	2.012	2.705	0.986
B1_PS_DE_WW	1.748	1.947	2.012	2.704	0.986
COMPLETE	1.749	1.947	2.012	2.705	0.986
BH_PS_WW	1.620	2.049	2.119	2.756	0.338
DE_BH_PS_WW	1.621	2.049	2.120	2.756	0.345
BH_DE_PS_WW	1.620	2.048	2.119	2.757	0.339
BH_PS_DE_WW	1.620	2.048	2.119	2.756	0.339

[100-09]	ABSTPR	ABSELO	ZERMELO	MISPTS	BRUNO
MD_PS_WW	1.516	1.411	1.462	2.022	1.037
DE_MD_PS_WW	1.518	1.413	1.463	2.023	1.040
MD_DE_PS_WW	1.518	1.411	1.462	2.024	1.039
MD_PS_DE_WW	1.516	1.411	1.462	2.022	1.038
B1_PS_WW	1.355	1.499	1.556	2.063	0.802
DE_B1_PS_WW	1.357	1.500	1.557	2.064	0.805
B1_DE_PS_WW	1.356	1.499	1.556	2.065	0.803
B1_PS_DE_WW	1.355	1.499	1.556	2.063	0.802
COMPLETE	1.357	1.499	1.556	2.065	0.804
BH_PS_WW	1.246	1.568	1.629	2.099	0.293
DE_BH_PS_BB	1.248	1.569	1.631	2.100	0.305
BH_DE_PS_WW	1.246	1.567	1.629	2.100	0.293
BH_PS_DE_WW	1.246	1.567	1.629	2.099	0.294

[50-06]	ABSTPR	ABSELO	ZERMELO	MISPTS	BRUNO
MD_PS_WW	1.383	1.145	1.270	1.626	0.904
DE_MD_PS_WW	1.382	1.144	1.270	1.626	0.904
MD_DE_PS_WW	1.383	1.143	1.269	1.627	0.905
MD_PS_DE_WW	1.383	1.144	1.269	1.626	0.905
B1_PS_WW	1.221	1.217	1.344	1.658	0.706
DE_B1_PS_WW	1.221	1.216	1.344	1.658	0.706
B1_DE_PS_WW	1.221	1.216	1.343	1.659	0.707
B1_PS_DE_WW	1.221	1.216	1.343	1.658	0.706
COMPLETE	1.220	1.215	1.342	1.659	0.705
BH_PS_WW	1.081	1.245	1.375	1.671	0.273
DE_BH_PS_WW	1.081	1.245	1.375	1.671	0.276
BH_DE_PS_WW	1.080	1.244	1.374	1.672	0.275
BH_PS_DE_WW	1.080	1.244	1.375	1.671	0.275

[150-10]	ABSTPR	ABSELO	ZERMELO	MISPTS	BRUNO
MD_PS_WW33	1.128	1.206	1.252	1.635	0.767
DE_MD_PS_WW33	1.133	1.210	1.256	1.638	0.776
MD_DE_PS_WW33	1.130	1.206	1.252	1.637	0.769
MD_PS_DE_WW33	1.128	1.206	1.252	1.636	0.768
B1_PS_WW33	1.024	1.175	1.227	1.630	0.596
DE_B1_PS_WW33	1.030	1.179	1.231	1.634	0.607
B1_DE_PS_WW33	1.026	1.175	1.227	1.633	0.598
B1_PS_DE_WW33	1.025	1.174	1.227	1.631	0.597
COMPLETE33	1.031	1.178	1.230	1.636	0.607
BH_PS_WW33	0.980	1.280	1.330	1.667	0.231
DE_BH_PS_WW33	0.986	1.283	1.333	1.670	0.254
BH_DE_PS_WW33	0.981	1.280	1.330	1.669	0.232
BH_PS_DE_WW33	0.980	1.280	1.330	1.668	0.232

[100-09]	ABSTPR	ABSELO	ZERMELO	MISPTS	BRUNO
MD_PS_WW33	1.127	1.134	1.183	1.561	0.792
DE_MD_PS_WW33	1.132	1.137	1.185	1.564	0.799
MD_DE_PS_WW33	1.129	1.134	1.182	1.563	0.794
MD_PS_DE_WW33	1.128	1.134	1.182	1.562	0.792
B1_PS_WW33	1.004	1.127	1.183	1.561	0.619
DE_B1_PS_WW33	1.009	1.131	1.186	1.564	0.629
B1_DE_PS_WW33	1.005	1.127	1.182	1.563	0.622
B1_PS_DE_WW33	1.004	1.127	1.183	1.562	0.620
COMPLETE33	1.009	1.129	1.184	1.567	0.629
BH_PS_WW33	0.940	1.237	1.292	1.607	0.233
DE_BH_PS_WW33	0.945	1.240	1.294	1.609	0.254
BH_DE_PS_WW33	0.940	1.237	1.291	1.608	0.234
BH_PS_DE_WW33	0.940	1.237	1.292	1.607	0.234

[50-06]	ABSTPR	ABSELO	ZERMELO	MISPTS	BRUNO
MD_PS_WW33	1.167	1.005	1.120	1.375	0.772
DE_MD_PS_WW33	1.167	1.004	1.119	1.375	0.773
MD_DE_PS_WW33	1.167	1.004	1.119	1.376	0.773
MD_PS_DE_WW33	1.167	1.004	1.119	1.375	0.773
B1_PS_WW33	1.000	0.977	1.106	1.365	0.620
DE_B1_PS_WW33	1.000	0.977	1.105	1.366	0.621
B1_DE_PS_WW33	1.000	0.976	1.105	1.366	0.621
B1_PS_DE_WW33	1.000	0.976	1.105	1.366	0.621
COMPLETE33	0.999	0.975	1.104	1.367	0.620
BH_PS_WW33	0.910	1.080	1.198	1.414	0.225
DE_BH_PS_WW33	0.910	1.080	1.198	1.414	0.229
BH_DE_PS_WW33	0.909	1.079	1.197	1.414	0.227
BH_PS_DE_WW33	0.909	1.079	1.197	1.414	0.228

Red is surely the dominant color. That means that, more often than not, the Direct Encounter favors who played a worse tournament. However the differences are so small that nothing definitive can be inferred.

Conclusion

If we feel that this research has some value, and if my opinion -that ABSELO and MISPTS look the more interesting global criteria (GC)- holds, we could deduct the following things:

1. The first tie-break criterion should be **<u>Median Buchholz</u>** (if all positions in the standings matter) or **<u>Buchholz Cut-1</u>** (if only positions at the top of the standings are important)
2. After that, when ratings are reliable, put **<u>APRO</u>** (Average Performance Ratings Opponent) after **Median**. As the rating criterion to be placed after **Buchholz Cut-1**, there is no much difference among ARO, AROC and APRO, although a very slight preference can be given to **<u>AROC</u>**.
3. If ratings are not reliable, use Sum of Progressive Points (also known as **<u>Progressive Score</u>**) as the second tie-break.
   The third tie-break should be **<u>Number of Wins</u>** (when there is an odd number of rounds in a tournament) or **<u>Number of Blacks</u>** (when there is an even number of rounds)
4. **<u>Direct Encounter</u>** is neither a good nor a bad tie-break. It is basically meaningless, so it is a choice of the tournament director whether to use it. When used, it is recommended to have it as the **second** criterion.
5. If needed to produce a single ordered list, my recommendation would be the following one:

1. Buchholz Cut-1	*In many instances, Median is better, but Cut-1 works ok with the top positions (which usually matter more) and for no Global Criterion Cut-1 is the worst Buchholz criterion. So it could be a good compromise for all situations.*
2. Direct Encounter	*There is not a specific recommendation to use it because it basically meaningless. But, if used, the second position in the tie-break list is its best placement*
3. APRO	*Even if AROC has slightly better marks for top positions in tournaments were ratings are highly reliable, APRO is valid in more general situations and probably also in real situations (the latter opinion need to be verified)*
4. Progressive Scores	*When APRO is used it is meaningless, otherwise it got the best marks as the second criterion (see considerations on Direct Encounter)*
5. Number of Wins	*Tournaments with an odd number of rounds are the majority, and in these tournaments it is better to reward the wins than the number of blacks.*

An important extension is the evaluation of unplayed games. As said before, this analysis does not involve them. If the method is deemed valid, it can also be used to analyze other simulated tournaments where the absence rate is way increased and where unplayed games are managed in the different ways that we want to check.

This is a quick list of methods, known or less known, that deal with unplayed games

Face value	FV	Unplayed games are computed as they were real games, so the standings points are used in tie-breaks. *Unfair, but very simple method. We should expect that this method will rank last.*
Draw against one's self	DOS	Any unplayed is considered as a draw against one's self. *The old way to deal with unplayed games. It should rank after virtual opponent.*

Virtual opponent	VO	Unplayed games are seen from two points of view. In computing the TB for a player who didn't play a game, these games are seen as real games played against a virtual opponent who usually has the same points of the player, gets a complementary result for the unplayed game and draws each game after it. For the opponent of a player who didn't play a game, these games are evaluated as draws. *After considering that an adjustment should be made (no forfeited games can bring more tie-break points than the ones against the scheduled opponent), this is the current way of doing things.*
Average sum of opponents points	ASOP	*This works only as a replacement for Buchholz - further analyses are needed for other tie-break criteria*. The games that are part of the evaluation are all the games played over-the-board by the real opponents of a player. The evaluation is computed averaging all these results (number of points divided by number of games).
Average tied players	ATP	*(Ashot's proposal)* The tie-break score of a player who withdraws from a tournament is given by the average final score of all the players that had his same score after he played his last game. Also the virtual opponent for an unplayed game may be computed in the same way (*using the average score at the end of the tournament of the players tied at that moment with the player that missed a game)*. Still undecided how to deal with unplayed games (not withdrawals) from the opponent standpoint (draw? face-value?)

Evaluation of unplayed games

(in Swiss tournaments)

by Roberto Ricca

Introduction

The goal of this paper is how to fairly evaluate unplayed games in the tie-breaks, particularly in the ones, like Buchholz and, subordinately[1], Sonneborn-Berger, where the opponents' score is used and the full array of opponents is needed.

In the following chapters, there will be a presentation of the most common methods used to evaluate unplayed games and the presentation of some new ones. Then there will be a description of the methodology used to evaluate these methods, and, finally, the results of such evaluation will be reported and commented.

Methods of Evaluating Unplayed Games (MEUGs)

Several methods, some very well known, some less known, some fairly new, will be presented in this chapter. Others can be added if deemed necessary.
Basically, nearly all these methods tend to evaluate a game from two points of view: the one of the player who, for whatever reason, missed a game; and the one of the opponents of the player who, during the tournament, missed a game.
This is the basic theme. In the following sub-chapters, the variations of such basic theme will be shown.

Here are some common definitions (related to a player P) that can be found in the sections below:

otbGames(P)	games played over the board by P
otbPoints(P)	points achieved by P in games played over the board
seenScore(P)	score of P, as seen by his opponents
finalScore(P)	final score (according to the standings) of P

Note: in the occurrences below, **(P)** *is omitted when obvious.*

For all purposes of this document, the standard score point system is applied (one point for a win -even if by forfeit- or for a PAB[2], half point for a draw or a half-point-bye (HPB), zero points otherwise).

Draw against oneself

This is the old way to deal with unplayed games, and it is also the simplest one: **any unplayed game is considered as a draw against oneself**.

It means that each unplayed game, whatever its nature is, will be replaced in the cross-table by a fictitious game where the opponent is the player himself and the result is a draw.

[1] An analysis prepared by the same author in the past showed that the tie-breaks of the Buchholz family are vastly superior to the Sonneborn-Berger tie-break.
[2] PAB => pairing-allocated bye, the bye assigned by the system, when in a round there is an odd number of players to pair

Of course, this operation changes the cross-table, including the part related to the fictitious final score (which is the *seenScore*), because, in the adjusted cross-table, the *seenScore* of each player is given by his *otbPoints* plus half point for each missed game. Of course, if a player did not miss any game, his *seenScore* equals his *finalScore*.

Virtual Opponent

This MEUG has the same behaviour of the *Draw Against Oneself* with respect to the *seenScore*, i.e., from the opponents' standpoint, any unplayed game of a player is seen as a draw.

The standpoint of the player himself, though, is different. Each unplayed game is replaced by a fictitious game that pits the involved player against a fictitious opponent (called *virtual opponent*) which ends with a fictitious score (called *virtual score*).
Such *virtual score* is a win, a draw or a loss, depending on the number of points that the player got in the round. Therefore, the *virtual score* is a win for a PAB or a forfeit-win, a draw for a HPB, and a loss otherwise.
The *virtual opponent* is a fictitious player who:

- has the same real score of the player before the unplayed game
- gets in the fictitious game the virtual score of the player's opponent (i.e. if the player won, it loses; if the player drew, it draws; and, of course, if the player lost, it wins)
- draws all the remaining games until the end of the tournament

An adjustment to the above formula has been presented during the years, in order not to favour too much the player who misses a game. This adjustment is applied to the first addendum of the *virtual opponent* formula (i.e. the real score of the player before the unplayed game):

- if the unplayed game comes from a forfeited game, the first addendum can never be higher than the (current) score of the scheduled opponent
- in the unplayed game comes from a bye (any kind), the first addendum can never be higher than the score of a fictitious player (the so-called *Mr. 50%*) who drew all its games before the round of the unplayed game

Ignore unplayed games

This MEUG has been proposed during the years, and has been actually used sometimes by the author of this paper. It boils down to a principle: all unplayed games are thrown away and the tie-break computation is based only on games actually played over the board.

The basic idea is to consider for each player X the average number of points he got in OTB games (i.e., *otbPoints(X)/otbGames(X)*), and then compute the tie-break of a player P by averaging the aforementioned averages of his OTB opponents

In formulae: $$\text{IgnoreTB(P)} = \frac{1}{\text{otbGames(P)}} * \sum_{\text{opp}=1}^{\text{otbGames(P)}} \frac{\text{otbPoints(opp)}}{\text{otbGames(opp)}}$$

However, this simple computation is somewhat disturbed by the fact that not all opponents have played the same number of games. Hence, instead of averaging the averages, it is better to use a weighted average, weighting each average depending on the number of games on which it is based and then dividing by the sum of these weights.

This means that each opponent average is multiplied by the number of otbGames (weight) played by the opponent, and the final sum is divided by the number of games played by all the opponents (which is the sum of all weights). After the proper simplifications, we get the final formula:

$$\text{IgnoreTB(P)} = \frac{\sum_{opp=1}^{otbGames(P)} \text{otbPoints(opp)}}{\sum_{opp=1}^{otbGames(P)} \text{otbGames(opp)}}$$

> In order to explain a weighted average, think of two months were John Doe earned respectively 6 quids per day (18 in all) and 4 quids per day (28 in all).
> What is John Doe's average earning per day? 5 quids ((6+4)/2)? Nobody would compute it in this way. Probably everybody would consider that John Doe worked three days the first month (3x6=18) and seven days the second one (7x4=28).
> In reality, John Doe earned 46 quids in 3+7 days, hence his average earning per day is 4.6 quids.
>
> It works in the same way for this average of weighted averages. One computes the points (the earnings of each month) and the games (the days of work of each month) separately. Then one sums the points (the total earnings), and divides for the sum of the games (the total days of work).

The total achieved by the previous computation is the *Ignore* tie-break value to look at. In order to get it more palatable with values everybody is more familiar with *(particularly for Buchholz)*, the aforementioned tb-value is multiplied by a constant factor given by the square of the number of rounds (e.g. 81 for a 9-round tournament, 49 for a 7-round tournament, and so on).

The method presented so far is a replacement for Buchholz. As a matter of fact, if a player plays all his games and his opponents play all their games, the final tie-break value for the *Ignore* method is coincident with the Buchholz value.

Things are not straightforward for the other tie-breaks that we intend to analyze.

The standard definition of the Sonneborn-Berger tie-break for a player is the sum of the points achieved by the players he beat, plus the half-sum of the points achieved by the players he drew with. The same result, though, is also reached by making a sum of several addenda, one for each opponent. Each addendum is given by the product of the points achieved by the opponent multiplied by the score achieved by the player in the game against such opponent (of course, when the player loses, the corresponding addendum is zero).

When unplayed games are ignored, the aforementioned sum of products (which, similar to the Buchholz case, is a weighted average of the OTB points, i.e. *otbPoints/otbGames*otbGames*, which is equal to *otbPoints*) is divided by the total number of games played by all real opponents (and adjusted with the same "squared" factor as in Buchholz).
Again, if a player plays all his games and his opponents play all their games, the final tie-break value computed as above is coincident with the Sonneborn-Berger value.

Regarding Buchholz Cut-1 and Middle-1 tie-breaks, there is the problem of who are the opponent(s) to be excluded from the computation. The most correct choice seems:

- for Cut-1 computation, to exclude the opponent whose record (made by a <points, games> pair) creates the lowest value for the tie-break
- for Middle-1 computation, to exclude also the opponent whose record creates the highest value for the tie-break

It is not necessarily the player with the lowest or the highest average. For instance, in Cut-1 computation, if one opponent scored 0/1 and another opponent scored 1/9, although the first one has a lower average, the Cut-1 of the involved player will usually result higher if the second opponent is excluded.

Face Value

This is a natural, albeit somewhat new, methodology. Everything is taken at *face value*, which means that there is no adjustment whatsoever. The final score, as it appears in the standings, is also the *seenScore*, i.e. the score used for the tie-breaks.

The unplayed games are divided into two categories, the forfeited games and the unscheduled games (PAB or scheduled absences, independent on the number of points received because of such absence).
Of course, this requires that the tournament report also records the forfeited games (this is not always done in practice).

Forfeited games are, for such tie-break purposes, considered like real games in the sense that a real opponent was defined by the pairing, and such opponent is considered like a real one, even if the game was not played.
For the other unplayed games no real opponent can be identified. An opponent that does not exist cannot score any point, hence the tie-break value of such an opponent is 0.
The same evaluation, of course, is reached considering such games as fictitious games played against fictitious opponents who scored zero points at the end of the tournament.

The Fair method

This is a completely new method of evaluating unplayed games. It takes some cues from other methods already seen, but, basically, it is a method that strives to be **fair**.

First of all, the unplayed games are divided into the following categories:

- forfeited games (wins or losses)
- requested-byes (usually HPBs: the player is absent but receives half-point anyway; also full-point-byes are part of this category, but they are very seldom used and are not considered in this analysis)
- PABs (the bye was assigned by the pairing rules, rather than requested by the player)
- pre-announced absence, which nets zero points for the player, and the tournament is not disturbed too much, as the player is not paired.
  A special case of announced absence (for multiple rounds) is the retirement from the tournament, which the Fair method considers differently from the announced absence from a round (see below).

The Fair method works in this way:

- like in the *Face Value* method, if a game was scheduled by the pairing controller, even though it was not played, from the tie-break standpoint, it is considered like a real game, hence each player will consider the other one as part of his array of opponents

- requested byes that create an advantage (often deemed unfair) for the player who receives them, are again considered as in the *Face Value* method, i.e. as fictitious games played against a fictitious opponent whose final score was zero points

- announced absences during the tournament (i.e. not a retirement), as they didn't create any advantage for the player, are treated similarly as in the *Draw Against Oneself* method, i.e. like a fictitious game played against a fictitious opponent that, at the end of the tournament, would have scored the same number of points as the player himself. However, differently from the *Draw Against Oneself* method, the result of this fictitious game is a loss for the player

- also PABs, although they provide free points without playing -but not at the player's choice- are managed like announced absence, i.e. like fictitious games played against a fictitious opponent that, at the end of the tournament, scores the same number of points as the player himself. In case of PABs, though, the result of the fictitious game is a win for the player

- a retirement is considered in a special way. For the player who retires from the tournaments, all the games he misses are managed as announced absences. However, from the standpoint of his opponents, the *seenScore* of a retired player is not the final score of the player but an adjusted score.
  Several types of adjustments were considered:
    - each remaining game is considered a draw (like in *Draw Against Oneself* or *Virtual Opponent* methods)
    - each remaining game is considered a loss (like in the *Face Value* method)
    - the *seenScore* of the player is given by prorating the standings score that the player had when he retired (in other words: in each remaining game the fictitious score is given by the average score of the player before the retirement)
    - the *seenScore* of the player is given by prorating the over-the-board score (i.e. unplayed games are not counted) that the player had when he retired (in other words: in each remaining game, the fictitious score is given the average score achieved in the games played over-the-board)
    - the *seenScore* of the player is given by the average (standings) score achieved at the end of the tournament by the players who, when he retired, had his same number of points

Summary of MEUGs

Below is a simple summary of the ten different MEUGs that were presented above and that will be subjected to testing in the following phases:

Main TB	Variant	Identifier
Draw Against Oneself		DrawSelf
Virtual Opponent	standard	StdVOpp
	adjusted	AdjVOpp
Ignore (unplayed games)		IgnoreUG
Face Value		FaceVal
Fair	(Ret) Draw	FairDraw
Fair	(Ret) Prorated Average	FairAvg
Fair	(Ret) Prorated OTB Average	FairBAvg
Fair	(Ret) Tied Players Average	FairTied
Fair	(Ret) Zero	FairZero

The Tie-Break Evaluation Methodology

The idea behind this methodology is to find a way to understand how a player really behaved in a tournament, independent on the final score.

Only a double round-robin tournament may provide a beyond-any-reasonable-doubt answer. As we know, a Swiss tournament is just a small subset of a double round-robin, and therefore it may easily happen that the final score is not a valid gauge of what a player showed in the tournament. Of course, the Swiss rules won't allow that, but if a player faced the strongest eight players in a tournament scoring 4 points and another player faced the eight lowest players in the tournament scoring 4.5 points, the former is an excellent player, while the latter is not a very good one, notwithstanding his higher final score.

A global criterion (GC) is a method that tries to discover the truth behind the standings. Two of them will be presented a bit later. For now, let's assume that they exist.

Although a GC, by definition, computes full standings for a tournament, since we are looking at evaluating tie-breaks, such standings should be adjusted depending on the number of points (i.e. the GCs are used as a sort of tie-break - they are quite complicated to compute, though, so they cannot be used in general practice).

Next step is computing all the tie-breaks and variants we are interested in evaluating (shown before), which means that, for each TB, we have corresponding full standings.

The following step is the comparison between the standings produced by a GC and a TB. Intuitively, the closer the TB standings are to the GC standings, the better. In other words, from the GC standpoint, the best TB is the one that produces the closest standings to the ones produced by the GC.

The factor used to evaluate the comparison is the **GC-TB standard-deviation** (GTS): for each player, take the squared difference between his positions in the GC standings and in the TB standings, and then average all these squared differences. The GTS is the square root of such average.

GC choice

This is probably the main step, because if the GC is not valid, anything that comes from it is invalid at the same time.
Based on the previous experience in evaluating tie-breaks (at that time five of them were evaluated), the choice of GC was limited to just two, quite different in their definition.
Then a third one was added, as a sort of negative benchmark.

Using more than one GC does not provide a definitive answer, but if some trends can be identified, they can be trusted, because they come from different paths.

Here is the description of the GC(s) that were computed and evaluated.

ABSELO (Absolute Performance by Elo rating)

Each player starts with the same rating. Following that, for each player the expected score is computed (using the rating table defined by FIDE - of course, for the first iteration everybody has an expected score of R/2, if R is the number of rounds in the tournament).

Then a new rating is computed taking the difference between the achieved score and the expected score, and multiplying it by a fixed value (K=50). Then the process of computing the expected score (this time based on the new ratings just computed) is repeated. And again, and again...
The process ends when the sum of the squares of the differences between the expected score and the achieved score is higher than the one resulting in the previous step. From a mathematical standpoint, this does not prove that there is no convergence for the process (a perfect convergence would be reached when the aforementioned sum is zero), but it is enough for our purposes.
The "rating" that each player had at that moment is the value used to compute the GC standings.

MISPTS (Missing points system)[3]

This method tries to compute a complete round-robin table for the tournament, inferring the missing results by means of the existing ones, following the logic shown below.
If the player A has beaten B, and B has beaten C, the result inferred for A-C is a win for A. It is a win for A even if either A-B or B-C ended in a draw. If both games ended in a draw, the inferred result is a draw. The process is repeated in order to progressively include all the missing results.
Basically, there is a direct arc between P and Q when P has beaten Q (it is a win-arc), or has drawn with Q (it is a draw-arc). If there is a path (i.e. a sequence of arcs) between X and Y, X beats Y if one of the arcs of the path is a win-arc, otherwise it is a draw (which means that all arcs are draw-arcs).
When there is more than one path between X and Y, the shortest one is used or, when of equal length, the one involving in the middle the higher rated player (for instance, if A drew with 1 and 1 drew with B, A-B is a draw, even if A beat 2 and 2 beat B).
If there is a path between X and Y and one between Y and X, the shortest one is used. When of equal length, the win path decides, if just one exists. Otherwise it is a draw.

Not a perfect system, because, besides its artificiality, it doesn't take into account the colours, but indicative anyway.

Random

The name is pretty indicative. The Random methodology consists in assigning a random number to each player and sort the players based on such number. As easily understood, this is the worst possible way to separate tied players, and any TB that behaves similarly to such GC is for sure a bad TB (as said before, the Random GC is used as a negative benchmark).

Tournaments

Ideally, only really played tournaments should be used in this evaluation. However, it is not easy to find tournaments of the kind needed for this analysis (i.e. tournaments with a reasonable number of unplayed games and of different types too). Moreover, even if some of them could be identified, they will be in such a low number than a statistical evaluation would not be very meaningful.

This is reason to choose simulated tournaments. In them, we can enter nearly every data that we are interested in evaluating. And a big number of them is not a problem.

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[3] An idea coming from Luigi Forlano, Ph.D. in Physics, and Vega's author.

The JaVaFo software has embedded a Random Tournament Generator (JVF-RTG) that can be tuned for our needs. With JVF-RTG, it is possible to configure the number of players; the number of rounds; the rate of forfeits, half-point-byes, zero-point-byes and retirements; the rating limits and also something else of not-immediate interest.
Players are then paired following the FIDE (Dutch) system and reasonable results are generated based on the rating of the players and the colours they receive *(this makes the results **very** reliable, probably more than in real life - an observation that has to be taken into account).*

The tournaments that were chosen for the evaluation were of two kinds. Just two, as a starter. But the results, as it can be seen later, are already quite indicative. Of course, now that the system is set up, it is possible to extend the tests, where deemed necessary.

The two types of tournaments were:

1. 100 players, 9 rounds (no other restrictions)
2. 200 players, 10 rounds (no other restrictions)

Results and considerations

Ten thousands tournaments were generated for each type of tournament. Each tournament reported a table of 30 GTS (three GCs for ten MEUGs).

The results below are the GTS averages of all ten thousand tournaments. Green values are the best ones, yellow values are in the 5% range of the best ones, red values are the worst ones, and orange values are in the 5% range of the worst ones.

Full table (100 players, 9 rounds)					
ABSELO		**BH**	**BHC1**	**BHM1**	**SB**
	StdVOpp	1.7688	1.7661	1.7498	2.4106
	AdjVOpp	1.7997	1.8020	1.7846	2.4166
	DrawSelf	1.7437	1.7453	1.7308	2.3736
	IgnoreUG	2.1263	2.1296	2.1954	2.4630
	FairBAvg	2.5448	2.2685	2.2878	2.7551
	FairTied	2.5235	2.2470	2.2797	2.6964
	FairAvg	2.5345	2.2520	2.2828	2.7501
	FairDraw	2.5119	2.2290	2.2581	2.6739
	FairZero	2.6306	2.3534	2.3962	2.9080
	FaceVal	3.0000	2.6962	2.7506	2.8476
MISPTS		**BH**	**BHC1**	**BHM1**	**SB**
	StdVOpp	2.2362	2.2274	2.2140	2.6656
	AdjVOpp	2.2590	2.2540	2.2397	2.6703
	DrawSelf	2.2139	2.2092	2.1963	2.6209
	IgnoreUG	2.5108	2.5074	2.5606	2.6158
	FairBAvg	2.8167	2.6017	2.6209	2.9267
	FairTied	2.8097	2.5933	2.6207	2.8811
	FairAvg	2.8103	2.5915	2.6178	2.9181
	FairDraw	2.8009	2.5785	2.6029	2.8678
	FairZero	2.8848	2.6713	2.7061	3.0288
	FaceVal	3.2136	2.9706	3.0156	2.9804
RANDOM		BH	BHC1	BHM1	SB
	StdVOpp	4.6545	4.6553	4.6552	4.6536
	AdjVOpp	4.6549	4.6553	4.6553	4.6535
	DrawSelf	4.6550	4.6549	4.6546	4.6536
	IgnoreUG	4.6554	4.6555	4.6564	4.6534

	FairBAvg	4.6545	4.6552	4.6549	4.6514
	FairTied	4.6562	4.6563	4.6563	4.6528
	FairAvg	4.6552	4.6560	4.6555	4.6520
	FairDraw	4.6555	4.6558	4.6559	4.6524
	FairZero	4.6563	4.6562	4.6560	4.6521
	FaceVal	4.6576	4.6571	4.6579	4.6527

As it can be seen, RANDOM values are basically the same all over the places. This is quite normal, after all. Any random placement will always put somebody, independent on the tie-break used, in such a wrong position that the ensuing squared difference is so big that will swallow all the others. Any deviance from this behaviour is rare, and disappears when averaging the results of ten thousands tournaments.

For these reasons, in the next tables, only the first RANDOM line is shown.

Table limited to players over 5.0 pts (100 players; 9 rounds)					
ABSELO		**BH**	**BHC1**	**BHM1**	**SB**
	StdVOpp	1.7296	1.6701	1.7084	2.4519
	AdjVOpp	1.7760	1.7235	1.7625	2.4659
	DrawSelf	1.7371	1.6658	1.7218	2.5066
	IgnoreUG	1.9661	1.9347	1.9834	2.5929
	FairBAvg	2.4155	2.0340	2.0852	2.7837
	FairTied	2.3879	2.0041	2.0645	2.7296
	FairAvg	2.4055	2.0147	2.0762	2.7769
	FairDraw	2.3751	1.9842	2.0424	2.7090
	FairZero	2.5186	2.1453	2.2235	2.9505
	FaceVal	2.6405	2.2483	2.3335	2.9375
MISPTS		**BH**	**BHC1**	**BHM1**	**SB**
	StdVOpp	2.1903	2.1586	2.1679	2.7355
	AdjVOpp	2.2229	2.1963	2.2062	2.7460
	DrawSelf	2.1947	2.1556	2.1758	2.7636
	IgnoreUG	2.3701	2.3571	2.3767	2.7695
	FairBAvg	2.6929	2.4057	2.4337	2.9898
	FairTied	2.6808	2.3927	2.4237	2.9471
	FairAvg	2.6874	2.3951	2.4276	2.9802
	FairDraw	2.6711	2.3777	2.4063	2.9349
	FairZero	2.7740	2.4943	2.5401	3.1020
	FaceVal	2.8793	2.5789	2.6319	3.0916
RANDOM		BH	BHC1	BHM1	SB
	StdVOpp	4.4739	4.4737	4.4725	4.4726

The results of the second set of tournaments.

Full table (200 players, 10 rounds)					
ABSELO		**BH**	**BHC1**	**BHM1**	**SB**
	StdVOpp	3.0331	3.0302	3.0152	4.2489
	AdjVOpp	3.0853	3.0903	3.0753	4.2612
	DrawSelf	2.9875	2.9918	2.9779	4.2867
	IgnoreUG	3.6211	3.6296	3.7242	4.4254
	FairBAvg	4.4080	3.8697	3.9082	4.8457
	FairTied	4.3762	3.8295	3.8926	4.7536
	FairAvg	4.3898	3.8406	3.8992	4.8403
	FairDraw	4.3631	3.8048	3.8625	4.7257
	FairZero	4.5796	4.0445	4.1224	5.1389
	FaceVal	5.3086	4.7202	4.8168	5.0891

MISPTS		BH	BHC1	BHM1	SB
	StdVOpp	3.8848	3.8737	3.8650	4.7207
	AdjVOpp	3.9232	3.9178	3.9089	4.7304
	DrawSelf	3.8438	3.8378	3.8295	4.7099
	IgnoreUG	4.3376	4.3371	4.4153	4.6720
	FairBAvg	4.9111	4.4916	4.5306	5.1745
	FairTied	4.9022	4.4740	4.5288	5.1027
	FairAvg	4.8986	4.4735	4.5254	5.1603
	FairDraw	4.8940	4.4553	4.5055	5.0908
	FairZero	5.0500	4.6357	4.7026	5.3629
	FaceVal	5.6944	5.2183	5.3021	5.3215
RANDOM		BH	BHC1	BHM1	SB
	StdVOpp	8.5269	8.5267	8.5264	8.5226

Table limited to players over 5.5 pts (200 players; 10 rounds)					
ABSELO		BH	BHC1	BHM1	SB
	StdVOpp	2.9992	2.9140	2.9767	4.3864
	AdjVOpp	3.0798	3.0067	3.0717	4.4105
	DrawSelf	2.9992	2.8945	2.9843	4.5657
	IgnoreUG	3.4430	3.4056	3.4846	4.7030
	FairBAvg	4.3058	3.5983	3.6818	4.9918
	FairTied	4.2626	3.5429	3.6441	4.9073
	FairAvg	4.2889	3.5654	3.6666	4.9824
	FairDraw	4.2468	3.5123	3.6115	4.8832
	FairZero	4.4990	3.8072	3.9354	5.3146
	FaceVal	4.7519	4.0231	4.1641	5.2978
MISPTS		BH	BHC1	BHM1	SB
	StdVOpp	3.8299	3.7886	3.8088	4.9005
	AdjVOpp	3.8869	3.8524	3.8749	4.9197
	DrawSelf	3.8254	3.7721	3.8105	5.0041
	IgnoreUG	4.1686	4.1603	4.1959	4.9913
	FairBAvg	4.7977	4.2584	4.3068	5.3659
	FairTied	4.7767	4.2299	4.2866	5.2982
	FairAvg	4.7849	4.2367	4.2953	5.3496
	FairDraw	4.7660	4.2080	4.2621	5.2864
	FairZero	4.9506	4.4218	4.5026	5.5780
	FaceVal	5.1698	4.6001	4.6940	5.5646
RANDOM		BH	BHC1	BHM1	SB
	StdVOpp	8.2874	8.2873	8.2893	8.2904

Conclusion

The numbers speak quite loudly: the old method (***Draw Against Oneself***) and the current one (***Virtual Opponent - Standard Variation***) draw consistently the best results. The ***Virtual Opponent - Standard Variation*** should not have replaced the ***Draw Against Oneself*** (as the results are not significantly better and, often, slightly worse), but once that has been done, there is no need to change the current method (although the ***Draw Against Oneself*** looks a lot easier to explain).

Dear chess friends,
A while ago I got a letter from the FIDE Technical Commission Secretary Mr. Filipowicz with the following:
“During the 2016 FIDE Congress in Baku you were so kind to accept the membership of the Sub-Committee to study the problem of unplayed games in the Buchholz system. Attached please find the examples regarding the matter. I would be very obliged if you kindly could send to TEC the results of your work until April 15, 2017, because we have to present it to FIDE to prepare the final text of our Chapter in the FIDE Handbook”

1. Singularity and history (part 1).

I found “the examples regarding the matter” which were sent to the Commission Secretary after the 2016 FIDE Congress. But there are a dozen of my letters “regarding the matter” which were sent to a lot of activists and principals of FIDE Commissions starting from FIDE Congress in Krakow. In fact I am not proud of this and I shall repeat it later in my letter. In Russia there is a saying which goes like this: “There is fish of first degree of freshness, there is fish of second degree of freshness, etc.’ Some proposals made by high officials are accepted without investigation. Others made by a non-member of any Commission are even not taken into consideration. As an example, I would like to quote a part of my letter which was written several years ago and sent to a lot of specialists including Mr. Filipowicz.

“At the 2009 FIDE Congress in Halkidiki (Greece), the FIDE Rules Commission adopted two key decisions regarding the use of additional performance indicators. Firstly, it was decided to forsake the cumulative progressive score (most frequently referred to simply as ‘progressive score’). Reason: two players achieve the same results in games with the same opponents, but the sequence of the games is different and their scores may differ as well. That is really a valid reason… Secondly, Gijssen, who was the FIDE Rules Commission Chairman at that time, received a proposal from a Dutch arbiter to change the principle of unplayed games counting from “draw against oneself” to “result against a virtual opponent.” Contrary to Swiss pairing programs and electronic clocks, which are tested by a group of arbiters, no proposals were submitted regarding any calculations. The proposal was to accept everything in good faith. One FIDE Rules Commission non-member noticed that mention was only made of the Buchholz score; somewhat alarmed, he asked, “How about the Sonneborn-Berger score?” Gijssen replied, after a while, that he had contacted the author of the proposal, who said everything was all right. One naïve FIDE Rules Commission non-member had scruples about asking further questions, assuming that the proposal was appropriate at least for the two most frequently encountered (round-robin and Swiss) tournament types. A year later it was revealed that in round-robin tournaments the same thing happens when using the Sonneborn-Berger score that was the reason for burying the progressive score. Again the “draw against oneself” principle was unearthed, especially as the use of the “result against a virtual opponent” system also turns all pluses and minuses other than the calculated result against a virtual opponent into 0.5 point. But the hammer had fallen back in 2009. Either there was no wish to grant an official status to “draw against oneself” or the need to do so was forgotten. But the idea started spreading around the world. In an article in his blog, Alexander Tkachev mentioned it as “a piece of advice from Gijssen.” Later the same advice, this time in written and official form, was given in *A Companion to a Chess Tournament Arbiter and Organizer* (Rybinsk, 2013, edited by Yuri Grachev). Subsequently, however, one FIDE Rules Commission non-member was really shocked when he looked through *FIDE Arbiters’ Manual* (a FIDE Arbiters’ Commission publication, 2014, authors Nikolopoulos, Gijssen, Dapiran, Stubenvoll, De Ridder, Vardapetyan, with the participation of Reuben, Anatharam and Ramstad). On p. 139 of that book it is written, "For Round Robin Tournaments any unplayed game should be counted to be a draw against the player himself." But if we look through all other documents of the Rules Commission, then we will read that the Buchholz counting principle of "draw against oneself" (without any regard for tournament type) becomes ineffective as of July 1, 2012. That is, the author of the aforementioned *Arbiters' Manual* paragraph is unfamiliar with official FIDE documents". Something similar has happened with the proposals to promote to a queen as a second option made by Ashot Vardapetyan. No analysis at all. On the contrary, the proposal to discuss AASO made during the 2011 Congress in Krakow was totally ignored.

2. "My" proposal

I want to be punctual when using the word "my". The new system was co-authored by three persons. Stewart initiated it in 2011. He mentioned "average of scores of opponents." I immediately said that opponents also could have unplayed games. So it was transferred to "average of average scores of opponents" (AASO). Later Mr. Roberto Ricca pointed that adding after multiplying is much better than multiplying after adding. So he was the first corrector. On the other hand, I could describe myself as a fighter against ignoring for any reason at all a proposal made by a non-member of any FIDE Commission during five years.

3. Singularity and history (part 2).

It was only after about 5 years later, after my letter to the FIDE President, that the matter was put on the FIDE Technical Commission's agenda. But in my letter to FIDE all kinds of tournaments were mentioned. Please note that in the letter from Mr. Filipowicz only Buchholz (BH) is mentioned. Once more a part of my letter (regarding the Sonneborn-Berger system – SB) is ignored. The Minutes of FIDE TEC meeting in 2016 include the following fragment: "The TEC expressed the opinion that unplayed games in the Round-Robin tournaments should be simply calculated as lost games in the Sonneborn-Berger system and Koya system". I took part in that meeting and I do not remember if the question was voted for. But let it be so. In this case there are two options: a) voters did not pay attention to the subject; b) voters decided to follow the way of other high principals by ignoring now only a part of the proposal made by a non-member of any FIDE Commission even after a letter from FIDE. By the way, I do not like those FIDE Congresses that are combined with Olympiads. They are always characterized by a shortage of time. Some members of Commissions are engaged as arbiters or perform other official duties. In the absence of an Olympiad, the results of Commissions' activities are much more productive.

4. What to do with SB?

It is still unclear to me which problems are resolved due to SB and which ones remain. Situation 1. SB is calculated in RR as a lost game. Does it mean that a new Sub-Committee for studying the problem of unplayed games in Swiss for SB will be established? Situation 2. So far, all kinds of tie-breaks (direct encounter, number of wins, number of games, played by black, etc.) are calculated by the same method. Does it mean that SB will be the only form of tie-breaks calculated differently in RR and Swiss? Situation 3. Sometimes the RR is the first stage for final Swiss and vice versa. Does it mean that the same game will be calculated first by one method and then by another?

5. Now how to calculate BH (which was explained many times and sent to a lot of people before the last Congress)

The first stage is highly similar to the method based on "draw against himself". All players get only their real points. E.g. a player played 8 games (where he got 5 points) and had one unplayed game (it makes no difference if the outcome was a plus or a minus). We count the player's BH points 5:8x9=5.625. An opposite player gets this point as a result of calculating BH. Now there is another situation. A player himself did not play one game. The calculation is the same. E.g. a player gets 20 BH points from 8 opponents. His/her points are 20:8x9=22.5. But what if a player played only 7 games out of 9? It's very simple. Instead of ":8x9" we use ":7x9".

6. When is such system not valid?

Theoretically, a winner can have 9 pluses in 9 games. It is strange that this player was not paired with the winner of second place. But if there are 200 players… It's no problem. Similarly to the case of direct encounter. We go to the second tie-break.

7. What to do in case of Double Swiss or Team Swiss?

The same approach is to be used. Let us say that a player did not play one game out of 14. So we take into account the opponents' BH points; then ":13x14". If the first tie-break in Swiss Team is match points, we do the same, taking into consideration match points. If priority is given to game points, we use game points in the calculation.

8. What to do with BH cut?

I do not know if BH median is used at present; but it makes no difference. It was not very clear how to calculate BH cut in case of using "draw against himself" or "virtual opponent" The problem that this unplayed game could be also the lowest one for BH. A funny point: first we construct a virtual opponent, then we kill him. In case of AASO there are no such doubts. First we cut the real lowest opponent. Then if there is one unplayed game, we take BH points of other opponents, e.g. 15 points. The calculation is 15:7x8=17.44.

9. How to calculate SB both in RR and Swiss?

The first stage is the same as with BH. All players get only their real points. E.g. a player played 8 games (where he got 5 points) and had one unplayed game (it makes no difference if the outcome was a plus or a minus). We calculate the player's SB points 5:8x9=5.625. Now let us assume that his/her opponent won the game. So the winner takes it all, 100 % of the 5.625 score. Suppose there was a draw. Then the opponent gets only 50% of 5.625 (2.81). Now let us assume that the opponent lost the game. It means that he got zero points. What to do if the opponent himself did not play one game. Let us say that he won 3 games, 2 draws and 3 games were lost. His result is 100% of points of 3 players, 50% of points of 2 players, and 0% of points of 3 players. All points are added. Let the sum be E. Then E:8x9 = final result.

10. **New proposal (now without s**ingularity and history)

According to the current regulations, all unplayed games are considered as played by White. In my opinion that isn't right. Let us assume we have Swiss, 9 rounds, 25 players, big difference in rating. The leader played white in 4 games and black in 3. Paired opponents understand the expected results. Suppose the opponents in games 8 and 9 do not appear. As a result, the player has 6 games played with White and only 3 with Black. My proposal is to consider an unplayed game as one that was played with “half-White” and “half-Black.” In case of one unplayed game there is no difference in ranking compared to the current system; but if there are 2 unplayed games, the colours ratio will be 1 to 1.

I would like to thank everyone for cooperation
IA Igor Vereshchagin (RUS)
Participant of 21 FIDE Congresses, non-member of any FIDE Commission, who has to pay 100 Euros for the right and opportunity to contribute to FIDE work during the Congresses
Gens una sumus

TEC Tromso Annex 1 date: 6.08.2014

Erdem UCARCUS

"Unplayed Games" in Buchholz System

And a Proposal for a New Approach

Introduction:

Handling or calculation methods of unplayed games in Buchholz system has always been a subject of many lively discussions in chess history. After July 2012 a new system known as "virtual opponent" introduced and became sole method handling of unplayed games of Buchholz tie-break. Here, our objectives are questioning of basic assumptions of the system and suggesting a different approach.

But, lets remember definition of virtual opponent system (VOS) first:

For tie-break purposes all unplayed games in which players are indirectly involved (results by forfeit of opponents) are considered to have been drawn.

For tie-break purposes a player who has no opponent will be considered as having played against a virtual opponent who has the same number of points at the beginning of the round and who draws in all the following rounds. For the round itself the result by forfeit will be considered as a normal result.

This gives the formula:

Svon = SPR + (1 – SfPR) + 0.5 * (n – R)

where for player P who did not play in round R:
n = number of completed rounds
Svon = score of virtual opponent after round n
SPR = score of P before round R
SfPR = forfeit score of P in round R

Example 1: in Round 3 of a nine-round tournament Player P did not show up.
Player P's score after 2 rounds is 1.5. The score of his virtual opponent is
Svon = 1.5 + (1 – 0) + 0.5 * (3 – 3) = 2.5 after round 3
Svon = 1.5 + (1 – 0) + 0.5 * (9 – 3) = 5.5 at the end of the tournament

Example 2: in Round 6 of a nine-round tournament player P's opponent does not show up.
Player P's score after 5 rounds is 3.5. The score of his virtual opponent is:
Svon = 3.5 + (1 – 1) + 0.5 * (6 – 6) = 3.5 after round 6
Svon = 3.5 + (1 – 1) + 0.5 * (9 – 6) = 5.0 at the end of the tournament

(from Fide Tournament Rules)

Our criticism are based on two arguments.

1. Ontological Argument

"For tie-break purposes all unplayed games in which players are indirectly involved (results by forfeit of opponents) ***are considered to have been drawn****."*

We are refusing to consider these games are drawn, whatever is the purpose, whoever is involved.

How can we consider these games have been drawn? These games never existed and never will be.

If a player does not show up; lost his game, the opponent gets one point. That is it, finished. This is reality.

If the player continues to getting points in following rounds as a virtual subject, even for tie-break purposes; this is distortion of reality.

We believe that we should remember Occam's razor and cut unnecessary, unreal assumptions as he advised.

2. Ethical Argument

This argument is tightly tied up to the first one. If the existence of scored points (again, even for tie break purposes) is questionable, all results produced using these points became unfair (degrees, prizes, rights etc).

So, what can we do?

How can we solve "unplayed game(s)" problem in Buchholz system?

1. We believe that **a better** method or methods can be found.

2. We believe that **an exact** solution of the problem probably does not exist. (will be discussed later)

1. Looking for a better solution:

Basic idea can be formulated as follows:

AvB = S / (N-n)

AvB: Average of sum of points scored by player's opponents (Average Buchholz)

S: Sum of points scored by player's opponents (unplayed games shall not be included)

N: Total round number of the tournament

n: Player's total number of unplayed games in the tournament

Example: In a 11 round Swiss system tournament

Round	1	2	3	4	5	6	7	8	9	10	11
Points scored by Player A's opponents	0 F	2.5	3.5	5	3 F	4.5	5	5F	6	6.5	7

$$\textbf{AvB} = \frac{\cancel{0.5} + 2.5 + 3.5 + 5 + \cancel{3} + 4.5 + 5 + \cancel{5} + 6 + 6.5 + 7}{(11-3)} = \textbf{40/8 = }\underline{\textbf{5}}\ \underline{\text{for player A}}$$

Additional Remarks:

a) If two player have got same "Average Buchholz" value, the player who has a bigger (N-n) number will get higher degree (i.e. more played game, less unplayed game).

b) If a player have got more than 3 unplayed games another tie break method should be preferred(for 7 round tournaments max. 2 unplayed game, can be better choice).

Discussion:
Main advantage of this method comes from to use only facts. It compares opponent's raw data and their playing history. It does not add points or changes anything and merely relying on softening effects of average function's on the extreme values of the processed data.

But there is a problem still not be solved. In the case of unplayed games, player's history does not fit each other's the most of time. Remember the Player A who has "8 game history" in our example; suppose that he has been tied with another player B who has "11 game history" Is it completely fair to compare average of 8 round value with 11 round one? We can't say, yes.

It is obvious that there is a dilemma here: Other methods (draw again himself and virtual opponent) changes and distorts the reality. They try to convert 8 round real results to 11 round-like twisted values via their own assumptions. But it is important to understand this is a futile attempt. The history can not to be substitude.

So, we have to choose.

We believe that purist methods has a principal advantage over approximative ones, even they are imperfect.

As a last word, we are hoping that it would be a small contribution the problems we have been faced.

Remark

In science, Occam's Razor is used as a heuristic (discovery tool) to guide scientists in the development of theoretical models rather than as an arbiter between published models.

Chess eNotation App

An Android App-based solution to record Chess moves!

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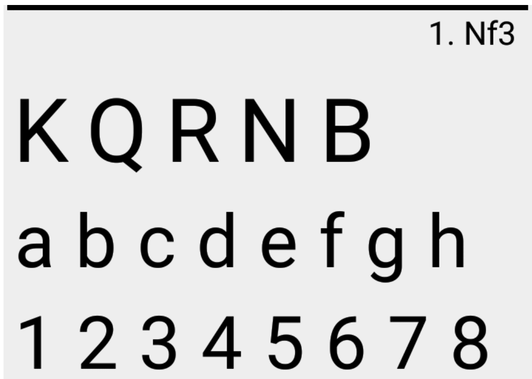

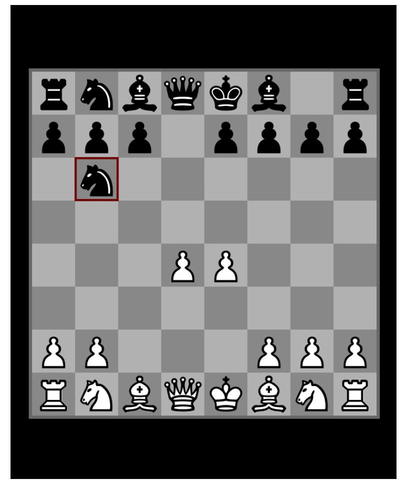

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**CMR is the working title*

NOTE: See Anti-Cheating measures mentioned in 'ChessKast broadcast App'

ChessKast Broadcast App

An App-based solution for Tourney organizers to broadcast live moves!

Problem

Currently, broadcasting live games from tournaments can be an expensive affair. It needs expensive electronic chess boards and an expert to set it up. Also needs a Web developer to show the games on the official site.
Consequently, not all tournaments get broadcasted and users/organizers lose on a very important element to make the tournament and game popular.

Solution: ChessKast

- Broadcast moves from tournaments using Android devices
- Moves can be recorded by **Player** or **volunteers** from the Organizing team. Its so simple, even a kid can enter the moves!
- Broadcast **multiple games from a single organizer-device** or one game per device
- Can easily broadcast **hundreds of games**, simultaneously
- Live game broadcast can be **artificially delayed** to thwart cheating attempts
- **Secure** live transmission and device/server storage
- **Sandboxed process** ensures no external program can manipulate the App
- Live games can be **viewed online** using PC or mobile devices with no additional effort for the organizers
- If required, organizers can easily embed live broadcast to their **official website** with few lines of code!
- Share **live pgn games link** with other Chess broadcasters and popularize the tourney
- Organizers can import round pairings directly from Chess-Results.com or in csv format and **avoid manual entries**
- **Intelligent alerts** back to the organizer (low battery, game state etc)
- Organizer can **edit live game (take back moves etc)** to correct any mistake, right from his Android device
- Play in silence, **no sound**, no distraction
- Server uses cloud technology and can easily handle thousands of live viewers
- **Fraction of a cost** of an electronic Chess board, for the whole tournament!

ANTI-CHEATING MEASURES

- **What if the Player attempts to open a Chess engine app during the game?**

The App can prevent the Players from opening other Apps. Alternately it can also automatically notify the Arbiter when the App is exited. App can only be exited when a Result is entered in the game.

- **What if the Player tries to get engine evaluation or outside help via the Internet?**

All internet communication can be blocked and device can be set to Airplane to prevent outside communication and interference.

- **What if the Player installs another App on the device which can read the live moves from the CMR App?**

Moves from the games can be encrypted on that device such that no other App installed on the device can reverse engineer and read it. The communication between Arbiter device and Player device can be secured such that one device knows when the App on the other device is tampered.

- **What if the Player creates a clone of the CMR App to assist with Engine analysis?**

Arbiter device would automatically be notified of the status of the Player device and if moves are being made. Since the player is not making moves on the original App, no moves would be recorded and the Arbiter device would get notified and the player caught.

Live Chess App for FIDE Events

An Android/iOS App to watch live Chess games from FIDE Events

FEATURES

- A **FIDE branded** App to watch official FIDE events on Android/iOS devices
- Users can get to know when a new **Tournament Starts**
- No hassles converting between timezones! Users can exactly know the start time of the next round, in **local timezone,** or choose to get notified when round starts!
- Watch multiple live boards, all in a **Single Screen**!

- Watch **Live Video** commentary and learn from the experts

- Interact with other Chess enthusiasts on **Twitter**
- Share the game position on **Social Media**
- **Analyze** current game with a Chess Engine. Or make own moves on the Analysis board!

- App is personalized for every user who can easily see his favorite player's **Rankings and games!**
- Play through **All Games** from previous rounds or search according to Players, Openings or Results!
- Download the Tournament games in **PGN format**
- Different **Board Themes** and Settings

TOURNAMENT ADMINISTRATION

- Simple Web interface to **manage tourneys** with **minimal time** to set up a new tournament
- Supports automatically adding latest player ratings and federation information from FIDE database
- **Automated** Tourney standings (can be generated by the Server or fetched from tournament websites and 3rd parties)
- Supports **correcting games** of a given round or tournament details (schedule etc)
- **Download PGN** of all or any particular rounds

VALUE ADD!

- **Server/App automatically scales** based on user load and can support a thousands of live users simultaneously (uses Cloud technology)
- Ability to **send custom messages** to user devices, informing about FIDE updates or any other promotional message
- **Automatic server alerts** via email when a round stalls or something goes wrong with the broadcast
- Can automatically **share the latest Results/Standings and round-start posts** to various social networks
- Can automatically **post engine analysis/evaluation** of the latest positions to various social networks
- Ability to display **Sponsor logos**
- **Gather important viewership statistics** and App usages

License Fees

USD 799 One-time setup fees

+

USD 99 per tournament

(includes Android and iOS Apps, Server & Hosting and critical bug fixes. Does not include cost of registering/maintaining Developer accounts with Google/Apple)