Appendix 1: The Working Rules of the Ratings System

<u>1. General Principles</u>

1.1 The ICCF Rating system is a numerical system in which percentage scores are convertible to rating differences and conversely, rating differences are convertible to winning expectancies.

1.2 The basis of the system is the multinomial logit probability function of statistical probability theory.

1.3 Rated tournaments must have a minimum reflection time of 20 days for 10 moves in postal and 150 days for 50 moves in electronic transmission. Tournaments with postal transmission will be evaluated only if they are administered on the ICCF Webserver. Responsible for this task are the TDs and the delegates of the national federations, respectively.

1.4 When a game is finished, the rating calculation procedure will use a player's rating from the newest rating list for those players with a published rating; otherwise, the start rating is used. However, if a player's current rating is lower than that player's start rating; the new ratings for that player's opponents are calculated using the player's start rating.

<u>2. Rating Procedure</u>

(NB: the steps below simply describe the rating process without notes or explanations for the sole purpose of defining the rating rules; both the full technical document, and a simplified guide for players, by Professor Mark Glickman describing the ICCF rating system in detail will be available from iccf.com.)

The following steps are to be computed in parallel for all players. The procedure assumes that every player at the start of the current rating period either has a rating and RD (a measure of rating uncertainty) at the end of a previous rating period, or that a player is unrated. The following steps determine the rating and RD at the end of the current rating period, and these are used as the starting point for the next rating period.

2.1. Determine the rating and RD for each player at the start of the new rating period based on their rating and RD at the end of the previous period (but see 1.4 above). For each player:

a. If the player is unrated and has declared a FIDE rating, set the rating to the FIDE rating (to be verified by the Ratings Commissioner) noting that ICCF considers only those FIDE lists which are valid starting at the same time as ICCF rating lists do, which means 1.1, 1.4, 1.7 and 1.10 of every year, and set the RD to 150. If the unrated player does not wish to declare a FIDE rating, set the rating to 1800, and set the RD to 250.

b. If the player is rated, use the player's rating from the last period, and calculate the new RD from the value at the last period (RD_{old}):

- If $RD_{old} > 120$, then $RD = RD_{old}$.
- If $RD_{old} \leq 120$, then $RD = \sqrt{RD_{old}^2 + c^2}$ where $c = 25$ is a constant that accounts for the increase in uncertainty between rating periods. If $\sqrt{RD_{old}^2 + c^2} < 30$, then set $RD = 30$.

2.2. Carry out the following updating calculations for each player separately:

For a specific player, assume that their pre-period rating is r, and the ratings deviation is RD determined from Step 2.1. Suppose the player competes against m opponents during the rating period. Let the pre-period ratings of the opponents (again from Step 2.1) be $r_1, r_2, \ldots, r_m$ and the ratings deviations be $RD_1, RD_2, \ldots, RD_m$. Also let $y_1, \ldots, y_m$ be the outcome against each opponent, with an outcome being either 1, 0.5, or 0 for a win, draw and loss. Note that multiple games against the same opponent are treated as games against multiple opponents with the same rating and RD. Let r' and RD' denote the post-period rating and ratings deviation for the player. The rating algorithm involves the following steps.

a) Convert the ratings and RDs to the standardized scale:

$$\mu = (r - 1500)/173.7, \sigma = RD/173.7$$

$$\mu_j = (r_j - 1500)/173.7, \sigma_j = RD_j/173.7 \text{ for } j = 1, \ldots, m$$

b) Set the system parameter values:

$$\beta_0 = 1.0986, \beta_1 = 0.17037$$

c) Define the probability of a win, draw and loss as a function of the standardized ratings μ and μ_j as

$$\Pr(\text{win}|\mu, \mu_j) = \exp(\mu)/S$$

$$\Pr(\text{draw}|\mu, \mu_j) = \exp\left(\beta_0 + (1 + \beta_1)\overline{(\mu + \mu_j)/2}\right)/S$$

$$\Pr(\text{loss}|\mu, \mu_j) = \exp(\mu_j)/S$$

where

$$S = \exp(\mu) + \exp\left(\beta_0 + (1 + \beta_1)\overline{(\mu + \mu_j)/2}\right) + \exp(\mu_j)$$

d) To account for the uncertainty in an opponent's rating in computing probabilities, the probabilities in step c are replaced with the average of probabilities evaluated at the opponent's rating of $\mu_j - \sigma_j$ and $\mu_j + \sigma_j$. Define

$Pw_j^- = \Pr(\text{win}|\mu, \mu_j - \sigma_j)$,

$Pw_j^+ = \Pr(\text{win}|\mu, \mu_j + \sigma_j)$,

$Pd_j^- = \Pr(\text{draw}|\mu, \mu_j - \sigma_j)$,

$Pd_j^+ = \Pr(\text{draw}|\mu, \mu_j + \sigma_j)$,

$Pl_j^- = \Pr(\text{loss}|\mu, \mu_j - \sigma_j)$,

$Pl_j^+ = \Pr(\text{loss}|\mu, \mu_j + \sigma_j)$

which involves replacing μ_j in the formulae in step c with either $\mu_j - \sigma_j$ or $\mu_j + \sigma_j$. Now let

$P_j = Pw_j^- + Pw_j^+$ if $y_j = 1$ (win against opponent j)

$P_j = Pd_j^- + Pd_j^+$ if $y_j = 0.5$ (draw against opponent j)

$P_j = Pl_j^- + Pl_j^+$ if $y_j = 0$ (loss against opponent j)

e) Let

$$w_{1j}^- = Pw_j^- + 0.5Pd_j^-,$$

$$w_{1j}^+ = Pw_j^+ + 0.5Pd_j^+,$$

$$w_{2j}^- = Pw_j^- + 0.25Pd_j^-,$$

$$w_{2j}^+ = Pw_j^+ + 0.25Pd_j^+$$

Now let

$$D_{1j} = \left(Pw_j^-\left(1 - w_{1j}^-\right) + Pw_j^+\left(1 - w_{1j}^+\right)\right)/P_j \text{ if } y_j = 1 \text{ (win against opponent } j)$$

$$D_{1j} = \left(Pd_j^-\left(0.5 - w_{1j}^-\right) + Pd_j^+\left(0.5 - w_{1j}^+\right)\right)/P_j \text{ if } y_j = 0.5 \text{ (draw against opponent } j)$$

$$D_{1j} = \left(Pl_j^-\left(0 - w_{1j}^-\right) + Pl_j^+\left(0 - w_{1j}^+\right)\right)/P_j \text{ if } y_j = 0 \text{ (loss against opponent } j)$$

Also let

$$D_{2j} = \left(Pw_j^-\left(1 - w_{2j}^- + 2w_{1j}^-(w_{1j}^- - 1)\right) + Pw_j^+\left(1 - w_{2j}^+ + 2w_{1j}^+(w_{1j}^+ - 1)\right)\right)/P_j - D_{1j}^2 \text{ if } y_j = 1$$
(win against opponent j)

$$D_{2j} = \left(Pd_j^-\left(0.25 - w_{2j}^- + 2w_{1j}^-(w_{1j}^- - 0.5)\right) + Pd_j^+\left(0.25 - w_{2j}^+ + 2w_{1j}^+(w_{1j}^+ - 0.5)\right)\right)/P_j - D_{1j}^2$$
if $y_j = 0.5$ (draw against opponent j)

$$D_{2j} = \left(Pl_j^-\left(0 - w_{2j}^- + 2w_{1j}^-(w_{1j}^- - 0)\right) + Pl_j^+\left(0 - w_{2j}^+ + 2w_{1j}^+(w_{1j}^+ - 0)\right)\right)/P_j - D_{1j}^2 \text{ if } y_j = 0$$
(loss against opponent j)

f) Now compute the updated ratings on the standardized scale:

$$\sigma' = \sqrt{\frac{1}{1/\sigma^2 - \sum_{j=1}^{m} D_{2j}}}$$

$$\mu' = \mu + (\sigma')^2 \sum_{j=1}^{m} D_{1j}$$

g) Convert μ' and σ' to the Elo scale:

$$r' = 173.7\mu' + 1500$$

$$RD' = 173.7\sigma'$$

3. At the beginning of each quarter, a new rating list is published. All results which were reported at least one month before will be eligible for inclusion on the next list.

4. Valid results from postal must be registered by the tournament directors on the ICCF webserver no later than one month before the list is to be made valid.

Rating Period	Games included	Published	Valid
1	September - November	Approx 15th December	January - March
2	December - February	Approx 15th March	April - June
3	March - May	Approx 15th June	July - September
4	June - August	Approx 15th September	October - December

5. Calculations are made with double precision floating point numbers. Values for rating and rating deviation are only rounded at the end of the calculations. Any intermediate values used for subsequent calculation steps are not rounded. At the end of the calculations, ratings are rounded to the nearest integer (.5 is rounded up), rating deviations are rounded to the nearest integer (.5 is rounded up), rating deviations are limited to the interval [30, 250].

6. Rules for the rating of games in team tournaments in which a substitute player takes part:

a) A game of a substitute player is only counted for the substitute's new rating if it is advantageous for the substitute player. Otherwise, the game is counted for the player who has been substituted.

b) For the opponent, the game is counted as being played against the player (the original or the substitute) with the higher rating.

7. These rules are valid on a continual basis since 01/10/2023.