Colley Royalty Method calculation – Updated October 2023

- Colley's original formula for any given team:

  (1 + ((wins – losses) / 2)) + sum of all opponents' ratings) / (2 + total games)

  The only difference between our formula and a pure Colley ranking is the concept of **"royalties". Royalties are our method for incorporating margin of victory (MOV)**, which Colley's method does not do.

  Our formula for a team's rating:

  (1 + ((wins – losses) / 2) + sum of all opponents' ratings + (sum of its royalties X royalty coefficient) / (2 + total games).

  Ties count as half a win and half a loss.

- **For every game a team plays, its royalty is calculated like this:**

  Opponent's rating + (capped MOV / 73).

  Capped MOV simply means margin of victory capped off at a given points threshold to avoid overadjustment to extreme blowout results. For football, the MOV cap is plus or minus 27 points. So if the actual margin of victory has an absolute value greater than 27, it will be capped at 27 or -27 in royalty calculations. Overtime games, like ties, have a capped MOV of 0. In recent basketball testing, it's been set at 13 points.

  *The MOV/73 factor for scaling rating is derived from linear regression.

  The calculation of royalties is changed for royalties that pertain to the **"Margin Adjustment Rule"**:

  If Team A beat Team B by 27 or more points, but its royalty against Team B is still lower than Team A's own rating, then the royalty instead becomes Team A's own rating. Conversely, if Team A loses by 27 or more points, but the royalty is still greater than Team A's rating, then the royalty is instead set to Team A's own rating.

  Without the Margin Adjustment Rule, much stronger teams could be negatively impacted for playing much weaker teams even if they blow them out, and weaker teams could benefit indiscriminately from playing much stronger teams even if they fail to play a competitive game.

- **Recenter** the average royalty to zero to avoid inflation and deflation. This keeps the average rating at 0.50, preserving the fractional proportionality of the Rule of Succession – from

which Colley's method was derived.

- **Royalty coefficient** controls how much royalties factor into the final equation. It is determined by finding a best-fit value that both avoids inflation/deflation and meets the specific needs of the sport, population set, and objective. The royalty coefficient for the football ratings live on our site is 1, which means the numerator in each team's formula includes the exact sum of its royalties. In recent basketball testing, it's been set at 0.11.

Potential improvements/new features in the pipeline include:

- Weighting games for home, away, and neutral sites

- Pre-season weighting that fully decays over the opening weeks of the season

- Automated linear regression for a continually updating points/rating scaler

- Function-based soft cap for calculating "capped MOV" to replace 27-point hard cap

- "Machine learning" – evaluative, retrodictive, and predictive analytics

- Advanced statistical methodologies for increasing precision in large population sets