# Mordhau Fight Club Statistics

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## 1 Abstract (Intro)

The purpose of this document is to provide the quantitative methodology by which teams in the MFC will be ranked. In other words, this is the in-depth explanation of the ELO system which will be employed.

## 2 What is ELO?

The ELO system infers a team's rating based on it's performances in matches against other rated opponents. As the numerics are intrinsically relative to one another, this system merely serves as a way to quantify a team's performance in order to create a list of "rankings." In general, the ELO system is balanced such that upsets would affect scores greater than a match played between similarly ranked opponents.

## 3 Specifications and Justifications

The format of these matches are best of 5 matches (or "maps"), each of which consist of a standard first to 7 skirmish. As such, questions arise as to how exactly the ELO system is to be proportioned. For the sake of this organization, ELO will be weighted based on final match results. This means that a final score of 3:2 would be a "lighter" win than a 3:0. This represents a compromise between a "winner-take-all" scenario and considering ever single round within each skirmish. Under this system, the overall winner is justly rewarded while the system remains stable enough such close matches would not result in devastating numerical consequences.

## 4 Equation

ELO is calculated based on the difference between your expected score and actual score. We assign an arbitrary number, say 1500, to be the desired "average" ELO. Let $A$ represent one team, and $B$ another. The expected score for team $A$ is calculated as:

$$E_A = \frac{1}{1 + 10^{(R_B - R_A)/400}}$$

Let $m_A$ be the number of matches won by team A, and $m_B$ be the number of matches won by team B. For the "actual" score of team A, we utilize the following proportion:

$$S_A = \frac{m_A}{m_A + m_B}$$

We add the term $25 \cdot \frac{m_A - m_B}{|m_A - m_B|}$ to provide a baseline for winners winning and a minimum deficit for losers losing.

Finally, the ELO system requires a volatility constant $k$. However, as this doesn't really affect relative standings, we've arbitrarily chosen $k = 150$ (this means the worst possible upset could result in at most a gain/loss of 150 elo).

Thus, our final equation is:

$$R'_A = R_A + 150\left(\frac{m_A}{m_A + m_B} - \frac{1}{1 + 10^{(R_B - R_A)/400}}\right) + 25 \cdot \frac{m_A - m_B}{|m_A - m_B|}$$

ELO will be rounded to the nearest integer for display.

# 5 Example

Let's suppose, for example, that team $A$ has an initial ELO of 1500, and team $B$ has an initial ELO of 1400 before their match. Let's say the final score ends up being a victory for team $A$ with match score $3:1$. We have:

$$R'_A = 1500 + 150\left(\frac{3}{3+1} - \frac{1}{1 + 10^{(1400-1500)/400}}\right) + 25 \cdot \frac{3-1}{|3-1|} = 1541$$

$$R'_B = 1400 + 150\left(\frac{1}{1+3} - \frac{1}{1 + 10^{(1500-1400)/400}}\right) + 25 \cdot \frac{1-3}{|1-3|} = 1359$$