MD5 of this file; trust no one

FE-CTF scoring

By organizers

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Introduction

FE-CTF uses a… novel scoring system. It appears that last year some players had trouble grasping its inner workings. Some questioned the sanity of its designer, and even the fairness of the system!

If you participated in FE-CTF last year and was one of those people then we must assume that you were not aware of the FAQ, which explains the system in a very approachable manner.

This year, we are using the system again with a very slight variation: The challenge weights are gone. Instead, challenges come in “series” which serve the same purpose. In short; if you understood the system last year, then you understand the system this year.

Challenge series

All challenges belong to a series. Some series only have a single challenge in them. The idea here is that challenges within a series are similar enough that solving one will give an advantage in solving the next, and therefore each should not give as many points as solving completely different challenges.

Each card on the challenge board represents a series. The hearts at the top of the card show which of the challenges in the series your team has solved (gray: not solved, purple: solved, red: first blood).

Wordy description

There are 1′000′000 points. Periodt. In other words, FE-CTF is a zero-sum game. Well, million-sum but you get the point.

Those points are initially distributed to challenge series, then individual challenges, and finally to the players:

1. Collect all series where at least one challenge has been solved by at least one team. Distribute the points evenly among those series.
2. Within each series, distribute its points evenly among those of its challenges that has been solved by at least one team.
3. For each challenge distribute its points among the teams that have solved it, giving a minor penalty to later solves.

Mathy description

Let

$P = 1'000'000$.

$D = \frac{99}{100}$.

T be the set of teams.

S be the set of series with at least one challenge solved by at least one team.

$C(s)$ be the set of challenges in series s solved by at least one team.

$R(t, c)$ be the ranking of team t for challenge c: 0 if t got first blood, 1 if they solved c second, etc., until ∞ if team t did not solve challenge c.

$p(x)$ be team x's total score.

Then

$$p(x) = \sum_{s \in S, c \in C(s)} \left\lfloor \frac{P}{|S| \cdot |C(s)|} \cdot \frac{D^{R(x,c)}}{\sum_{t \in T} D^{R(t,c)}} \right\rfloor$$

Example

Let

$T = \{$"Kenshoto", "Goons", "DDTEK"$\}$

$S = \{$"Minicomputer", "Garbage", "Blackbox"$\}$

$C($"Minicomputer"$) = \{$"Minicomputer 1", "Minicomputer 2"$\}$

$C($"Garbage"$) = \{$"Garbage"$\}$

$C($"Blackbox"$) = \{$"Blackbox"$\}$

Solves listed first to last for each challenge:

- "Minicomputer 1":
  - "Goons"
  - "DDTEK"
  - "Kenshoto"

- "Minicomputer 2":
  - "Kenshoto"
  - "Goons"
- "Garbage":
  - "Kenshoto"
- "Blackbox":
  - "DDTEK"

Therefore R is

$c \backslash t$	"Kenshoto"	"Goons"	"DDTEK"
"Minicomputer 1"	2	0	1
"Minicomputer 2"	0	1	∞
"Garbage"	0	∞	∞
"Blackbox"	∞	∞	0

And so we can compute, e.g. $p(\text{"Goons"})$ as

$$\begin{aligned}
p(\text{"Goons"}) &= \sum_{s \in S, c \in C(s)} \left\lfloor \frac{P}{|S| \cdot |C(s)|} \cdot \frac{D^{R(\text{"Goons"}, c)}}{\sum_{t \in T} D^{R(t,c)}} \right\rfloor \\
&= \left\lfloor \frac{P}{3 \cdot 2} \cdot \frac{D^{R(\text{"Goons"},\text{"Minicomputer 1"})}}{\sum_{t \in T} D^{R(t,\text{"Minicomputer 1"})}} \right\rfloor \\
&+ \left\lfloor \frac{P}{3 \cdot 2} \cdot \frac{D^{R(\text{"Goons"},\text{"Minicomputer 2"})}}{\sum_{t \in T} D^{R(t,\text{"Minicomputer 2"})}} \right\rfloor \\
&+ \left\lfloor \frac{P}{3 \cdot 1} \cdot \frac{D^{R(\text{"Goons"},\text{"Garbage"})}}{\sum_{t \in T} D^{R(t,\text{"Garbage"})}} \right\rfloor \\
&+ \left\lfloor \frac{P}{3 \cdot 1} \cdot \frac{D^{R(\text{"Goons"},\text{"Blackbox"})}}{\sum_{t \in T} D^{R(t,\text{"Blackbox"})}} \right\rfloor \\
&= \left\lfloor \frac{P}{3 \cdot 2} \cdot \frac{D^{0}}{D^{2} + D^{0} + D^{1}} \right\rfloor \\
&+ \left\lfloor \frac{P}{3 \cdot 2} \cdot \frac{D^{1}}{D^{0} + D^{1} + D^{\infty}} \right\rfloor \\
&+ \left\lfloor \frac{P}{3 \cdot 1} \cdot \frac{D^{\infty}}{D^{0} + D^{\infty} + D^{\infty}} \right\rfloor \\
&+ \left\lfloor \frac{P}{3 \cdot 1} \cdot \frac{D^{\infty}}{D^{\infty} + D^{\infty} + D^{0}} \right\rfloor \\
&= 139'028
\end{aligned}$$

For reference:

$$
\begin{aligned}
p(\texttt{"}\text{Kenshoto}\texttt{"}) &= 472'083 \\
p(\texttt{"}\text{DDTEK}\texttt{"}) &= 388'886 \\
p(\texttt{"}\text{Goons}\texttt{"}) &= 139'028
\end{aligned}
$$