Disciplina: Rating System

TeachMePlease, https://teachmeplease.com
Serokell, https://serokell.io

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Rationale

The current architecture of the platform relies on *third parties* called Archivists to provide information on the existence of the Educators and the quality of education. However, we suppose that these third parties would tend to rate large educational institutions and ignore private teachers and small schools (see e. g. Times Higher Education ratings). Thus, it worth examining whether we can stop relying on the Archivists.

With Archivist nodes being removed, the following security concerns arise:

- A malevolent student can forge educational records by creating a fake Educator node.
- A corrupted Educator can create fake students to increase the size of the dataset.

Moreover, a *grade* is a biased measure of students' knowledge. However, a recruiter is generally interested in an unbiased one. It is clear that unbiased measures are hard to achieve in the current setting, but it is safe to assume that the better the quality of education is, the less biased the grades are.

Requirements

1. The rating system should define at least two mappings:
   - Student's rating $R_S : (studentId, subjectId) \to Int$
   - Educator's rating $R_E : (educatorId, subjectId) \to Int$

   The implementation, however, can define additional rated entities if necessary.
2. The mappings should be temporal: they should adjust in time to reflect changes in education quality and students' knowledge.
3. $R_S(\mathbf{S_1}, x) > R_S(\mathbf{S_2}, x) \iff$ the student $\mathbf{S_1}$ has deeper understanding of the subject x than $\mathbf{S_2}$.
4. $R_E(\mathbf{E_1}, x) > R_E(\mathbf{E_2}, x) \iff$ the students of the educator $\mathbf{E_1}$ on average have deeper understanding of the subject x than the students of $\mathbf{E_2}$.
   Let $\Omega_{i,x}$ be the set of the students that have acquired a rating in some ATG subgraph of the subject x by taking courses of the educator $\mathbf{E_i}$. Then for every pair of educators $\mathbf{E_1}$ and $\mathbf{E_2}$ and subject x the following should hold true:

$$R_E(\mathbf{E_1}, x) > R_E(\mathbf{E_2}, x)$$
$$\Updownarrow$$
$$\frac{1}{|\Omega_{1,x}|} \sum_{s \in \Omega_{1,x}} R_S(s, x) > \frac{1}{|\Omega_{2,x}|} \sum_{t \in \Omega_{2,x}} R_S(t, x)$$

5. The ratings should be based solely on the on-chain sources of information and should not require third-party oracles.

6. The ratings should be protected from fraud:

   - It should not be possible for any student with rating $R_S(\mathbf{S}, x) = r_1$ to get new rating $r_2 > r_1$ without completing courses in x.
   - It should not be possible for any educator with rating $R_E(\mathbf{E}, x) = r_1$ to get new rating $r_2 > r_1$ without teaching students in x.