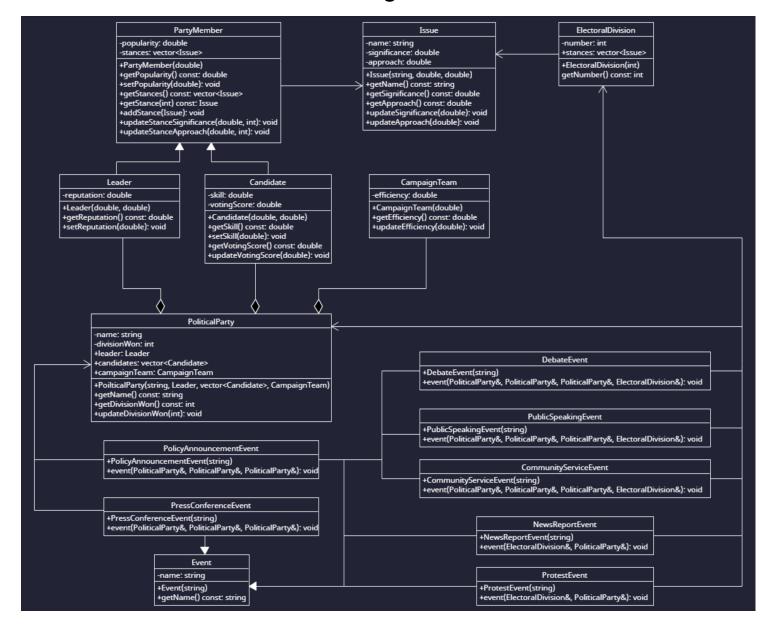# Truong Giang Nguyen - 7378609

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UML diagram

Issues

Issue 1: Diseases
Description: Diseases pose a significant threat to public health. The spread of diseases such as COVID-19, HIV/AIDS, and malaria can have devastating effects on populations, straining healthcare systems and impacting economies.

Issue 2: Deforestation

Description: Deforestation involves the removal or clearing of forests, often to make way for agricultural activities, logging, or urban development. This can lead to loss of biodiversity, disruption of ecosystems, and contribute to climate change.

Issue 3: Climate change
Description: Climate change refers to long-term shifts in temperatures and weather patterns. The main cause is human activity, particularly the burning of fossil fuels which increases levels of greenhouse gasses in the atmosphere. This can lead to a variety of environmental problems including rising sea levels, extreme weather events, and threats to wildlife.

Issue 4: Water contamination
Description: Water contamination involves the pollution of water bodies with harmful substances such as chemicals, waste products, and microorganisms. This can harm aquatic life and make water unsafe for human consumption and use.

Issue 5: Poverty
Description: Poverty refers to the state of not having enough material possessions or income for a person's needs. It can lead to a variety of social issues including lack of access to education, poor health outcomes, and increased crime rates.

Political Parties

Political party 1: Communist
Description: The Communist party advocates for a society in which all property is publicly owned and each person works and is paid according to their abilities and needs. They focus on promoting equality and believe that the state should play a significant role in controlling the economy.

Political party 2: Democratic
Description: The Democratic party is committed to the principle of social equality. They advocate for a mixed economy where both the private sector and the state direct the economy. They often support progressive social policies, workers' rights, and welfare programs.

Political party 3: Republican
Description: The Republican party champions a platform based on limited government intervention, free-market capitalism, and individual liberty. They often advocate for lower taxes, less regulation, and a smaller government with reduced spending.

Each party has a name, number of divisions won (initially 0), leader and a set of candidates (corresponds with number of electoral divisions) and a campaign team.
For each party, for each issue, the range is generated randomly.
Significance and approach have different upper bounds and lower bounds. Upper bounds are generated between 50.0 and 100.0, lower bounds between 0.0 and 50.0, using uniform distribution, then the significance and approach are generated between these bounds and assigned to leader and candidates.

Here is the code for this:

```cpp
random_device rd;
mt19937 gen(rd());

for (int i = 0; i < 5; i++) { // There are 5 issues
    uniform_real_distribution<> disUpper(50.0, 100.0); // Upper bound
    uniform_real_distribution<> disLower(0.0, 50.0);  // Lower bound

    double significanceRangeUpper = disUpper(gen); // Upper bound for significance
    double approachRangeUpper = disUpper(gen); // Upper bound for approach

    double significanceRangeLower = disLower(gen); // Lower bound for significance
    double approachRangeLower = disLower(gen); // Lower bound for approach

    uniform_real_distribution<> disSignificance(significanceRangeLower,
significanceRangeUpper); // Significance range
    uniform_real_distribution<> disApproach(approachRangeLower, approachRangeUpper);
// Approach range

    double significance = disSignificance(gen); // Generate significance between the
significance range
    double approach = disApproach(gen); // Generate the approach between the approach
range

    this->leader.addStance(Issue(issueName(i), significance, approach)); // Assign stance to
leader

    for (Candidate& candidate : this->candidates) {
        candidate.addStance(Issue(issueName(i), significance, approach)); // Assign stance to
each candidate
    }
}
```

Electoral Divisions and Candidates

- Each electoral division has a number (represented by n) for their order and a set of stances. The division number corresponds to the number of printed out candidate's number. For each stance, both significance and approach are generated randomly between 0.0 and 100.0 using uniform distribution. Here is the code for this:

```cpp
random_device rd;
mt19937 gen(rd());

for (int i = 0; i < 5; i++) { // There are 5 issues
    uniform_real_distribution<> dis(0.0, 100.0);
    double significance = dis(gen); // Generate significance
    double approach = dis(gen); // Generate the approach
```

```
    stances.push_back(Issue(issueName(i), significance, approach)); // Assign stance to
electoral division
    }
```

- Each candidate will have popularity, a set of stances, skill and voting score (initially set equals to 0, popularity, stances and skill are generated randomly using uniform distribution). They are all generated randomly. The skill and popularity are updated through events (skill will update popularity and itself), and popularity will be used to calculate voting score directly. The stances are used to calculate the euclid distance with the stances of electoral division, which is also used to calculate the voting score directly. Candidates can be involved in debate events, public speaking events, community service events.

Leader and Campaign managerial team

- Each leader has popularity, a set of stances and reputation. Popularity, stances and reputation are generated randomly using uniform distribution. Reputation and popularity are updated through events (reputation will update popularity and itself) and popularity will be used to calculate voting score directly. Leaders can join leader-related events like policy announcements and press conferences.
- Each campaign team has efficiency, which is generated randomly using uniform distribution and used in debate events to update the candidate's popularity. Campaign teams can join in debate events.

Events

There are 7 events:
- Debate event: debate events include the candidate and campaign team of each party. Each party will have a point calculated by candidate skill * 2 + team efficiency. Then it generates a random number between 0 and the sum points of 3 parties. if random < party 1 points, party 1 wins. if party 1 point < random < party 2 point, party 2 wins. Else, party 3 wins. The winning candidate will increase his popularity by his skill * 0.15 + team efficiency * 0.1. His skill will be increased by (current skill) * 0.2, team efficiency will be increased by (current efficiency) * 0.15.
- Public speaking event: this is a candidate-related event. It involves 3 parties' candidates. For each candidate, a random number will be generated between 0 and his skill. If the random number is bigger than 40% of that candidate skill, he will increase popularity by (current skill) * 0.2. His skill will be increased by (current skill) * 0.25. If the random number is smaller than 40% of that candidate skill, he will decrease popularity by (current skill) * 0.3 and his skill will be decreased by (current skill) * 0.375.
- Community service event: this is a candidate related event. It involves 3 parties' candidates. For each candidate, a random number will be generated between 0 and

his skill. If the random number is bigger than 66% of that candidate skill, his popularity and skill will increase by (current skill) * 0.25 and (current skill) * 0.2, respectively. If the random number is bigger than 33% of that candidate skill, his popularity and skill will increase by (current skill) * 0.15 and (current skill) * 0.1, respectively. Else, hs popularity will only increase by (current skill) * 0.05 and skill will not change.

- Policy announcement event: this is a leader-related event. It involves 3 parties' leaders. For each leader, it will generate a random number between 0 and his reputation. If that number is greater than reputation 40% of the leader's reputation, his popularity and reputation will be increased by (current reputation) * 0.2 and (current reputation) * 0.25, respectively. Else, his popularity and reputation will be decreased by (current popularity) * 0.3 and (current popularity) * 0.375, respectively.

- Press conference event: this is a leader-related event. It involves 3 parties' leaders. For each leader, it will generate a random number between 0 and his reputation. If that number is greater than 75% of the leader reputation, his popularity and reputation will be increased by (current reputation) * 0.25 and (current reputation) * 0.3, respectively. Else if that number is greater than 50% of the leader reputation, his popularity and reputation will be increased by (current reputation) * 0.15 and (current reputation) * 0.1, respectively. Else if that number is greater than 25% of the leader reputation, their popularity and reputation will be decreased by (current reputation) * 0.15 and (current reputation) * 0.1, respectively. Else, their popularity and reputation will be decreased by (current reputation) * 0.25 and (current reputation) * 0.3, respectively.

- Protest event: this is an issue-related event. It involves an electoral division and a party (this party is chosen randomly before assigned to this event). It generates 5 random integers from 0 to 4 for index in the stances set of division. Then, the significance of the chosen issue/stance will be increased by a random number between 0 and 15. After that, if the significance is greater than the significance of the correspond stance of the candidate of the party, the significance of candidate will be increased by the difference of the two significance * 0.2. Else, the significance of candidate will be decreased by the difference of the two significance * 0.2.

- News report event: this is an issue-related event. It involves an electoral division and a party (this party is chosen randomly before assigned to this event). It generates 5 random integers from 0 to 4 for index in the stances set of division. Then, the approach of the chosen issue/stance will be increased by a random number between 0 and 15. After that, if the approach is greater than the approach of the correspond stance of the candidate of the party, the approach of candidate will be increased by the difference of the two approach * 0.2. Else, the approach of candidate will be decreased by the difference of the two approach * 0.2.

Winner

Voting score of each candidate in each electoral division is calculated base on this formula:

First, calculate euclid distance between a stance of candidate and corresponding stance of division: sqrt((candidate Significance - division Significance)^2 + (candidate Approach - division Approach)^2)

There are 5 issues, so we calculated the average by summing all the 5 euclid distances and then dividing by 5.

The voting score is then calculated by: 1500/(Average euclid distance) + candidate popularity/5 + leader popularity/10
(Use 1500/(Average euclid distance) to make sure that who has less average euclid distance will have a higher voting score)