

# Assignment 2

## Issues and Stances

### Issues

- **Global Warming:** Reducing carbon emissions is crucial for Verdeloria due to its vulnerability to rising sea levels and extreme weather, impacting public safety and future generations.
- **Healthcare Reform:** Expanding access to affordable healthcare services is necessary as Verdeloria's healthcare system is underfunded, especially in rural areas.
- **Education Access:** Increasing funding for public education to improve its quality.
- **Infrastructure Development:** Improving roads for transport efficiency and safety.
- **Rights of Pets:** Urban and suburban voters, where pet ownership is high, demand better animal welfare protections.

### Model Stances

The significance and strength values reflect the importance of issues to the electorate and how strongly candidates or divisions align with them, affecting campaign dynamics.

## Political Parties and Candidates

### Political Parties

- **Verdelorian Progressives (VP):** Focuses on environmental and social reforms, popular with younger, urban voters.
- **National Unity Party (NUP):** Appeals to conservative, older voters, prioritizing national security and infrastructure.
- **People's Alliance (PA):** Supports local governance, popular in rural divisions where citizens feel underrepresented.

### Leaders

- **Sarah Greenfield (VP):** Highly popular for environmental policies and progressive reforms with popularity of 80%.
- **Richard Adams (NUP):** Moderate popularity, focuses on security and economic stability with a popularity of 75%.
- **Emily Howards (PA):** Less popular but has strong rural support for grassroots movements with a popularity of 65%.

### Candidates

Candidates are assigned to divisions and attempt to win votes based on their alignment with the division's stance on five national issues. Their stances are initially randomised but can evolve due to campaign events.

- **Verdelorian Progressive Candidate for Riverton:** Jacob Harris

**Popularity:** 0.78

**Stances on National Issues:**

- Global Warming: (0.8, 0.9)
- Healthcare Reform: (0.7, 0.85)
- Education Access: (0.6, 0.75)
- Infrastructure Development: (0.5, 0.6)
- Rights of Pets: (0.9, 0.88)

- **National Unity Party Candidate for Seaforth:** Olivia Clarke

**Popularity:** 0.72

**Stances on National Issues:**

- Global Warming: (0.5, 0.6)
- Healthcare Reform: (0.65, 0.7)
- Education Access: (0.55, 0.6)
- Infrastructure Development: (0.8, 0.9)
- Rights of Pets: (0.6, 0.65)

- **People's Alliance Candidate for Lakeshore:** Liam Murphy

**Popularity:** 0.66

**Stances on National Issues:**

- Global Warming: (0.7, 0.8)
- Healthcare Reform: (0.6, 0.7)
- Education Access: (0.7, 0.65)
- Economic Equality: (0.5, 0.6)
- Infrastructure Development: (0.6, 0.7)

## Stances Initialisation

Each candidate's stance on the five national issues is initially generated by drawing random values from a uniform distribution between 0 and 1. This ensures that while all candidates from the same party begin with similar positions on issues, individual candidates can have slight variations. Over time, these stances may change in response to campaign events, allowing candidates to adjust their positions to better appeal to voters or react to shifting dynamics in their electoral division.

## Electoral Divisions

### Division Names

- |                |                 |
|----------------|-----------------|
| 1. Riverton    | 8. Stonebridge  |
| 2. Seaforth    | 9. Fernhill     |
| 3. Lakeshore   | 10. Willowgrove |
| 4. Woodcrest   |                 |
| 5. Northgate   |                 |
| 6. Pinecliff   |                 |
| 7. Brightwater |                 |

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# Campaign Event Rules and Probabilities

## Campaign Event Rules

### 1. Candidate-Related Events

#### Event 1: Impact on Candidate Popularity

- **Rule:** Each candidate in the electoral division will have their popularity adjusted by a random factor that ranges from -0.1 to +0.1
  - **Implementation**
    - Generate a random float within this range
    - Update the candidate's popularity, ensuring it remains within the valid range of (0, 1].

#### Event 2: Change in Candidate Stances

- **Rule:** Each candidate can change their stance on the issue. The new stance is randomly generated within a range based on the current stance.
  - **Implementation:**
    - For each candidate, generate a new stance within a small range around the current stance (e.g.,  $\pm 0.1$ ).
    - Ensure the new stance remains within the valid range of (0,1]

### 2. Leader-Related Event

#### Event 3: Impact on Leader Popularity

- **Rule:** The leader's popularity will be impacted by a random factor, similar to the candidates, but with a slightly larger range (e.g.  $\pm 0.15$ )
  - **Implementation:**
    - Generate a random float within this range.
    - Update the leader's popularity, ensuring it remains within (0, 1].

### 3. Issues-Related Event

#### Event 4: Change in Electoral Division Stances

- **Rule:** The electoral division's stance on the issue will be adjusted based on public sentiment, represented by a random change.
  - **Implementation**
    - Generate a random float within a small range ( $\pm 0.05$ )
    - Update the divisions' stance, ensuring it stays within (0, 1]

## Probability Distribution

### 1. Candidate-Related Events

- **Event 1:** Impact on Candidates' Popularity (probability, 0.4): This even has a higher probability because changes in candidate's popularity can significantly influence election outcomes.
- **Event 2:** Impact on Candidates' Stances (probability, 0.2): Adjustments in candidates' stances can also be crucial, but perhaps less immediate than changes in popularity.

### 2. Leader-Related Event

- **Event 3:** Impact on Leaders' Popularity (probability, 0.2): Leader popularity is important, and its influence is considered significant but balanced with other factors.
3. **Issues-Related Event**
- **Event 4:** Impact on Division's Stance on Issues (probability, 0.1): This event has a lower probability, reflect that changes in the divisions stance on issues might occur less frequently or have a less immediate impact compared to other events.

## Coefficients Derivation

To compute the voting score for each candidate in an electoral division, we use the formula:

$$\text{Voting Score} = A \times (\text{Stance} - \text{and} - \text{Population Factor}) + B \times (\text{Candidate Popularity}) + C \times (\text{Leader Popularity})$$

## Coefficient Requirements

The coefficients A, B and C must satisfy the following:

- $A + B + C = 1$
- $A > B > C$

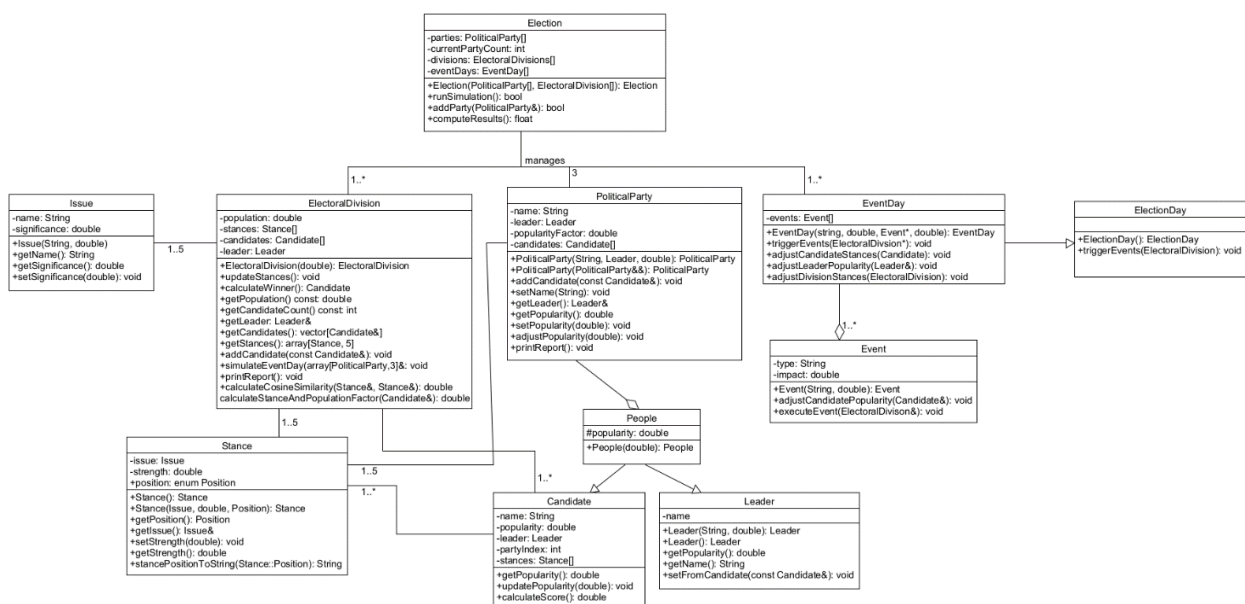
## Derivation Process

1. **Select a Base case for C:** Start with a smaller value, e.g.,  $C = 0.1$
2. **Choose B:** Select a value greater than C, e.g.,  $B = 0.2$
3. **Calculate A:**
  - Use the sum condition:  $A = 1 - B - C = 1 - 0.2 - 0.1 = 0.7$
  - Verify the order:  $A > B > C$  (True, since  $0.7 > 0.2 > 0.1$ )

## Final Coefficients

- $A = 0.7$  (Stance-and-Population Factor)
- $B = 0.2$  (Candidate Factor)
- $C = 0.1$  (Leader Factor)

## UML Diagram



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