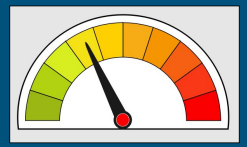
A. Word Game

Alice and Bob Word Game

SPECIALITE

Alice and Bob Word Game



SPECIALITE

guess

SEPTEMBRES

Score:
2 + 4

clue

1. Problem Definition

- **Game Setup:** **Alice** chooses a 10-letter word randomly from a dictionary. **Bob** proposes words from the same dictionary.
- **Scoring** for each word Bob proposes:
  - + 1 point for each correct letter.
  - + 2 if the letter is in the correct position.
- Game played over k rounds (k = 5, 10, or 15).
- Total score for Bob is the sum of scores
- **Goal:** maximize the total score over 100 games.
- Conditions: precomputation runtime (< 1 hour), game runtime (few mins).
- Expected scores: 30 (k=5), 60 (k=10), 74 (k=15).

Approach

Letters Frequency:

E	A	S	I	N	T	R	L
17.35%	8.2%	7.93%	7.53%	7.17%	6.99%	6.65%	5.92%

Bi-gram Frequency:

ES	LE	DE	RE	EN	ON	NT	ER
3.05%	2.22%	2.17%	2.1%	2.08%	1.64%	1.62%	1.53%

Words Grades:

Mot	Score
Declaration	70
Réactions	69
Technologie	62
Programmée	49

2. Heuristic Greedy Strategy

- Precompute **letter** frequencies of each letter in the entire dictionary.
- **Calculate Bi-gram** frequencies: For each letter, the frequency of the letters that follow it.
- **Calculate** the frequency of each letter at each position in the word.
- Compute a **grade** for each word according to frequency metrics.
- **Greedy** first guess
  - Choose from candidate words with the maximum grade.
- Use the clue signal for informed guesses
  - Filter candidate words to ensure only words with matching scores remain.

3. Results

- **Code: word guessing game**
- **Scores:**
  - **k = 5:** score 32.08
  - **k = 10:** score 61.34
  - **k = 15:** score 75.83
  - Could slightly vary due to random guessing on ties
  - Achieved expected scores
- **Runtime:**
  - Precomputation: 0.31 s
  - 100 games: 1 minute