Semester Project Report

“ League Championship Algorithm”

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Table Of Contents

S.No	Section	Page No.
1.	Introduction	3
2.	Methodology	3
3.	Complexity Analysis	4
4.	Real-World Application	5
5.	Limitations	5
6.	Addressing CLOs	5
7.	Conclusion	6
8.	GitHub Repository Link	6

INTRODUCTION

The League Championship Algorithm (LCA), inspired by sports leagues, is a metaheuristic optimization method introduced to tackle complex real-world problems. Each 'team' in the algorithm represents a possible solution, and through simulated matches over multiple seasons, teams evolve to become stronger solutions. LCA is suitable for problems where traditional methods are inefficient or fail to scale well.

METHADOLOGY

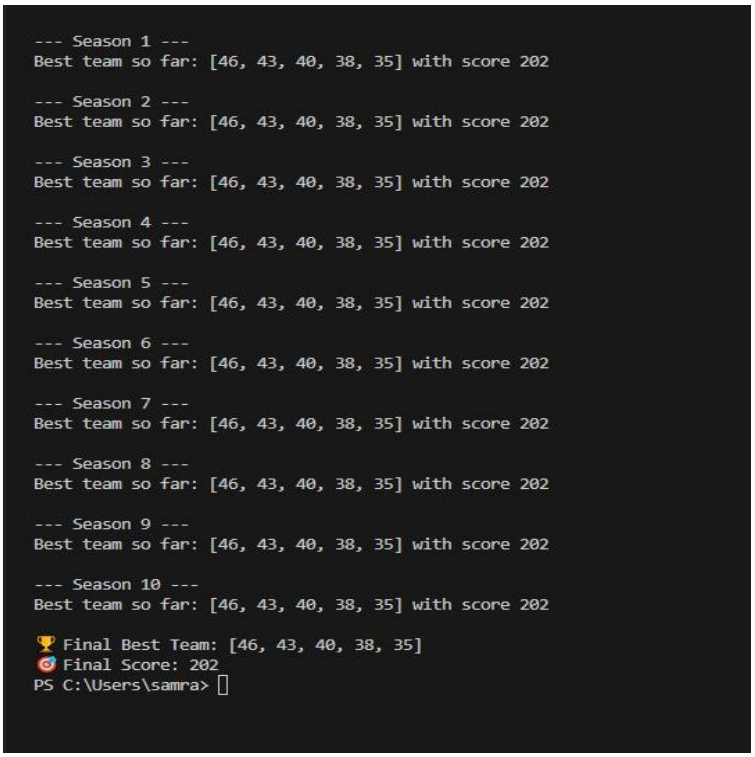
1. Pseudocode:

1. Initialize league with random teams (candidate solutions)
2. For each season:
   a. Shuffle and pair teams to compete
   b. Evaluate fitness of each team
   c. Determine winners and losers
   d. Update losers by learning from winners (with randomness)
   e. Track the best-performing team
3. Return the best team after all seasons

2. Python Implementation:

The algorithm was implemented in Python. Each team is represented by an array of 5 player stats, and the sum of these values determines the team's strength. Over 10 simulated seasons, weaker teams update their strategies by learning from stronger ones. This mimics evolution in real sports leagues.

Output:



COMPLEXITY ANALYSIS

- **Time Complexity:**
  O(S × N)
  where S = number of seasons, N = number of teams

  - **Space Complexity:**

    O(N × team_size)

REAL-WORLD APPLICATIONS

In this project, the LCA was applied to simulate a football league ranking system. Each team's stats were evaluated and updated across multiple simulated seasons. This approach can be used in sports AI engines, fantasy league simulations, and competitive game simulations where teams must evolve and adapt over time.

LIMITATIONS

• May converge prematurely if diversity is lost • Performance varies with parameter tuning
• Lacks theoretical guarantee of finding global optimum

ADDRESSING CLOs

CLO	Description	Addressed In
2.1	Explain NP, NPC, approximation	Introduction & Pseudocode
3.1	Implement algorithm, solve problem	Python Code, Output
4.1	Analyze time/space complexity	Complexity Section
4.2	Asymptotic notations	Theoretical Analysis
5.1	Evaluate real-world use	Application Section
6.1	Design solution creatively	Methodology & Evolutionary Design

CONCLUSION

The League Championship Algorithm offers a dynamic and realistic approach to optimization by mimicking sports competitions. The Python simulation successfully demonstrated how teams improve over time, reflecting real-world adaptation. The model was easy to implement, effective in evolution, and conceptually intuitive.

GitHub Repo Link:

https://github.com/saif01234567/AoA-Sem-Project.git