

Augmenting the Approximation

Exact solution

Brute-force DFS → optimal but exponential

Approximation

Greedy selection of highest-weight edge → fast but not always accurate

Let's analyze the polynomial time algorithm!

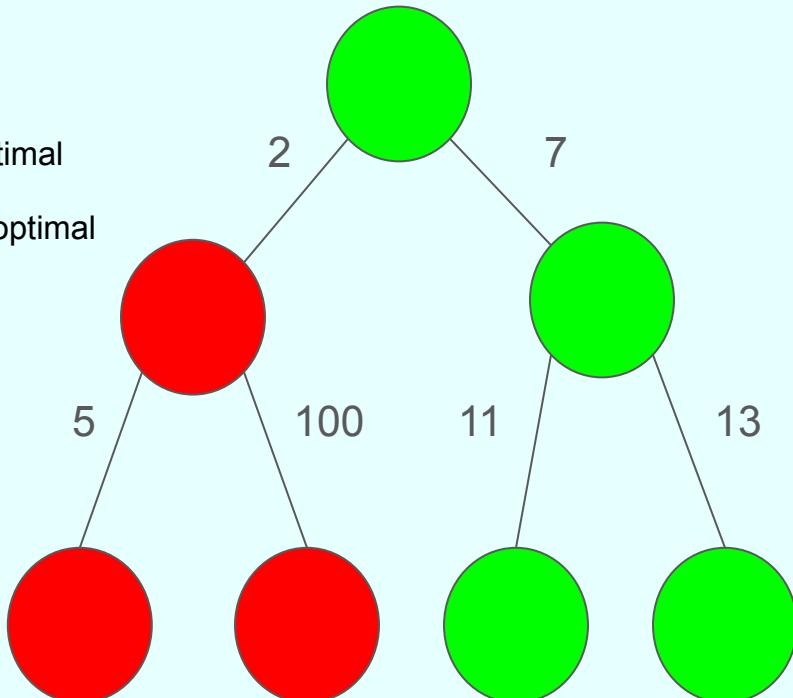
Observing Performance

Across 1,090 tests:

- Most approximation results fall between **70–90%** of optimal
- **5 test cases** showed severe *failures*: only **54–65%** of optimal

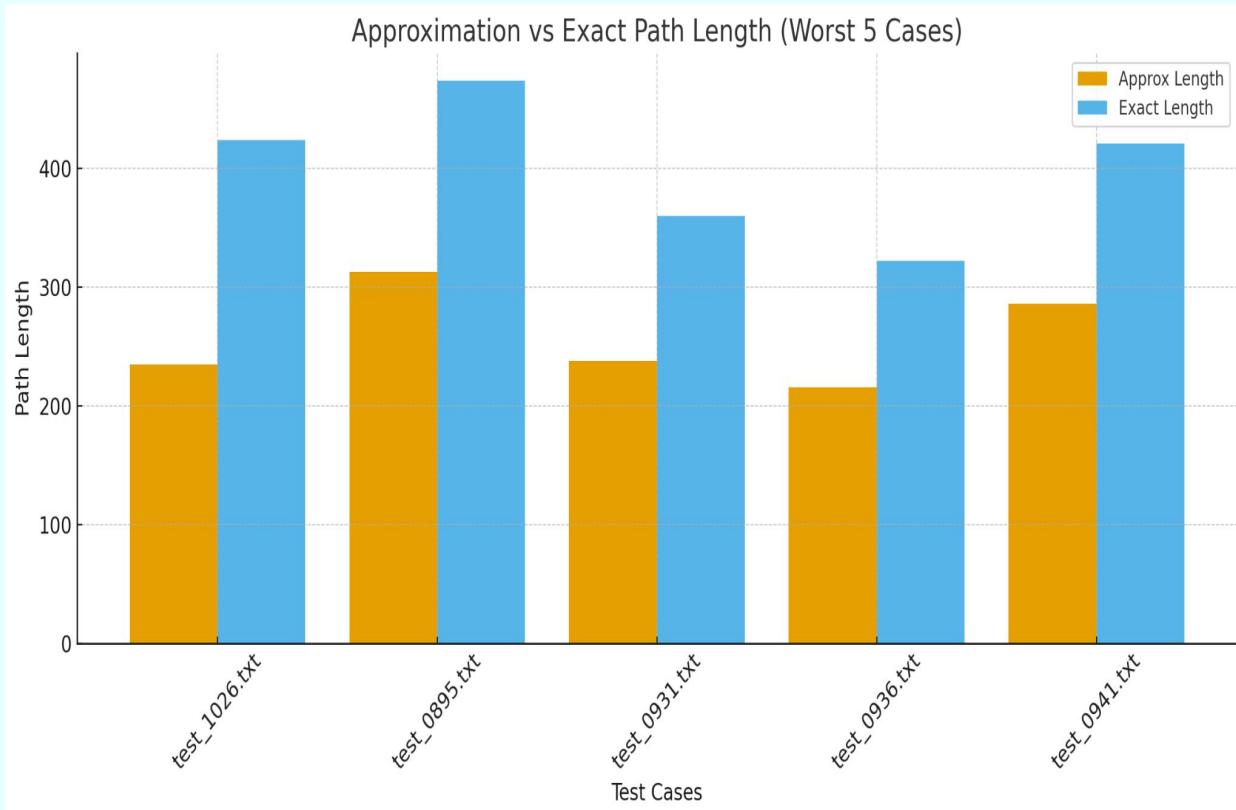
The greedy approach is usually OK...

...but occasionally collapses **dramatically**.



What Makes Greedy Fail?

- Choosing purely locally is globally destructive
- Therefore, the “solution” may get lead into dead regions
- Test cases with greedy “traps”



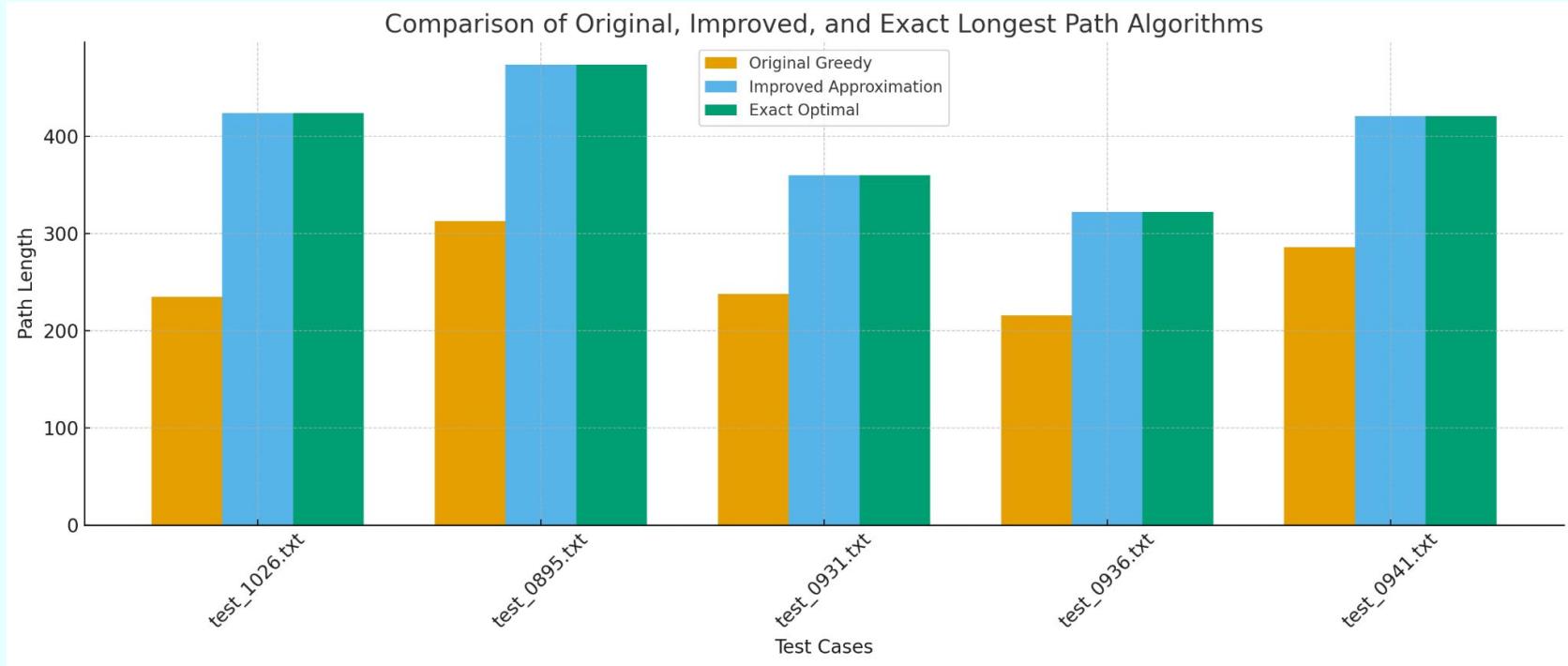
How Can We Make Suboptimal More Optimal?

- Adding a Look Ahead :

“If I go here, What is the best thing i can do after that”

- Allowing a check for a better potential future to not lead into dead ends where the longest path cannot be achieved
- Changes from $O(E)$ -> $O(E * \text{degree of vertex})$

How the Look Ahead Augment Affected Accuracy on the Five worst test cases from before



Types of Graphs Where the Improved Approximation Algorithm failed

- The improved solution has a harder time with larger graphs
- < 9 Vertices
- < 15 edges

