N-Way Splay Tree Insert Complexity Proof

Shyamal Suhana Chandra

1 Theorem: N-Way Splay Tree Insert Complexity

Statement: Inserting into an N-way splay tree with n nodes takes $O(\log n)$ amortized time.

2 Proof

1. Find insertion point: $O(\log n)$
2. Insert node: $O(1)$
3. Splay new node to root: $O(\log n)$ amortized
4. Adjust branching if needed: $O(1)$ amortized (infrequent)
5. Total: $O(\log n)$ amortized

Conclusion: N-way splay tree insert has $O(\log n)$ amortized time complexity.