Huffman Coding and PageRank

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Huffman Coding Example

- **Problem**: Compress “AABBCC”.
- Assign shorter binary codes to frequent characters.
- **Step-by-Step**:
  1. Frequencies: A:2, B:2, C:2.
  2. Build tree: Codes A:0, B:10, C:11.
  3. Compressed: 001010101111 (12 bits vs. 48).

Huffman Coding

- Builds binary tree based on character frequencies.
- Shorter codes for frequent characters.
- **Time Complexity**: $O(n + k \log k)$, k = unique characters.
- **Space Complexity**: $O(k)$.

PageRank Example

- **Problem**: Rank webpages A, B, C with links A$\rightarrow$B, B$\rightarrow$C, C$\rightarrow$A.
- Assign importance based on incoming links.
- **Step-by-Step**:
  1. Initial ranks: 1/3 each.
  2. Iterate: A = (C's rank)/1, etc.
  3. Result: Equal ranks (simplified).

PageRank

- Ranks nodes based on incoming links.
- Uses iterative updates with damping factor.
- **Time Complexity**: $O(\text{iters} \times E)$.
- **Space Complexity**: $O(V)$.