

Problem 1: Implement 2-Approximation for Vertex Cover

Given an undirected graph G, implement a 2-approximation algorithm for the Vertex Cover problem.

- Input: A graph represented as an edge list.
- Output: A vertex cover set of size at most $2 \times \text{OPT}$

Tasks:

- Greedily pick an uncovered edge and add both endpoints to the cover.
- Repeat until all edges are covered.

Sample Input	Sample Output
5 4 0 1 0 2 1 3 3 4	4 0 1 3 4
Explanation: First line: the number of vertices and edges. Next 4 lines: Unweighted edges	Explanation: First line is the size of the cover, second line lists vertices

Problem 2: Compare Approximation with Exact Vertex Cover

For small instances:

- Compare the performance of the 2-approximation Vertex Cover and the optimal solution (using brute-force for small graphs).
- Visualize how the approximation ratio behaves.

Sample Input	Sample Output
4 3 0 1 0 2 1 3	Approximate: 2 0 1 Exact: 2 0 1 Approximation Ratio: 1.00