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Experiment No. 9

Aim – To implement Approximation Algorithm

Details – An Approximate Algorithm is a way of approach NP-COMPLETENESS for the optimization problem. This technique does not guarantee the best solution. The goal of an approximation algorithm is to come as close as possible to the optimum value in a reasonable amount of time which is at the most polynomial time. Such algorithms are called approximation algorithm or heuristic algorithm. An algorithms for a problem has an approximation ratio of ρ (n) if for any input of size n the cost C of the solution produced by the algorithm is within a factor of ρ (n) of the cost C* of an optimal solution.

$$\text{Max}(C/C^*, C^*/C) <= \rho(n)$$

We have an algorithm ρ (n)-approximation if it achieves an approximation ration of ρ (n)

For maximization problem $0 < C <= C^*$

For minimization problem $0 < C^* <= C$

For the vertex cover problem, the optimization problem is to find the vertex cover with fewest vertices, and the approximation problem is to find the vertex cover with few vertices. Formally, a vertex Cover of a graph G is a set of vertices such that each edge in G is incident to at least one of these vertices.

The decision vertex-cover problem was proven NPC. Now, we want to solve the optimal version of the vertex cover problem, i.e., we want to find a minimum size vertex cover of a given graph. We call such vertex cover an optimal vertex cover C*.

The following algorithm is an example of Vertex Cover approximation.

```
ApproximationVC(G)
1.  C ← phi
2.  E' ← E[G]
3.  While E'!= phi
4.      Do let (u,v) be an arbitrary edge of E'
5.      C ← C U {u,v}
6.      Remove every edge incident on u as well as v from E'
7.  Return C
```

Important Links:

1. YouTube Video: https://www.youtube.com/watch?v=WS7EQpYTAwI
2. Reading Resource: https://www.javatpoint.com/daa-approximation-algorithm-vertex-cover

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Input – Graph G(V,E) of at least 10 vertices.

Output – Approximate Vertex Cover for the given graph.

Submission –

1) C/C++ source code of implementation
2) Verified output for the written source code with multiple inputs
3) One page report of Exp. 9