CSI 35 LECTURE NOTES (Ojakian)

Topic 18: Spanning Trees

OUTLINE

(References: Rosen: 11.4, 11.5)

1. Spanning Trees.
2. Minimum weight spanning trees
3. DFS, BFS, and Backtracking

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1. Spanning Trees
   (a) Definition.
   (b) Graph has spanning tree IFF connected
2. Two ways: Breadth-first search and Depth-first search
   In both cases, algorithms to find a spanning tree in a graph. Both have the following property:
   (a) Start at any vertex.
   (b) Stop when all the vertices of the graph are in your tree.
3. Find with Breadth-first search
   (a) Say the start vertex is at level 0.
   (b) Iteratively do the following for each vertex at level k:
   Add an edge to each of its unprocessed neighbors
4. Find with Depth-first search
   (a) Add edges in along a path till all neighbors are processed.
   (b) Backtrack as little as possible, and continue.
5. Backtracking Application
   (a) Coloring with $\leq k$ colors - decision problem.
6. Cops and Robber Again
   (a) Copwin spanning tree
   (b) Our research question: Do spanning trees yield all winning strategies?
7. Minimum Cost Spanning Tree
   (a) Definition
   (b) Find by greedy construction (either Prim-Januk or Kruskal)

8. Exercises

   (a) Section 11.4: 1 - 12, 23
   (b) Section 11.4. DFS/BFS. 13 - 16, 17abc, 18abc, 19 - 21
   (c) Section 11.4. Coloring and Backtracking: 26, 29, 30
   (d) Section 11.5. Min Cost. 1 - 4 (use Prim or Kruskal), 9