Homework 6

Jeremy Wright
CSE598 - Analysis of Algorithms

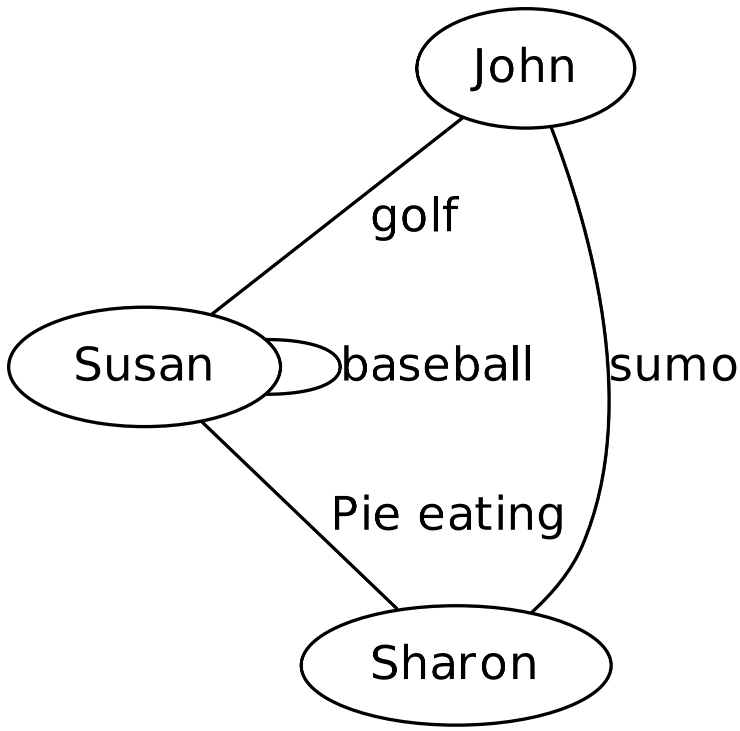
December 1, 2013

Problem 8.1a. Yes, there might be a reduction from interval scheduling to vertex cover, however, this reduction is useless. Interval scheduling has a known polynomial time algorithm, thus, if we "reduce"an easy problem to a hard problem we have only created more work for ourselves.

Problem 8.1b. Independent set reduces to Interval scheduling? Unknown since that would answer P vs. NP. Independent Set is NP hard. Interval scheduling has a polynomial time algorithm so if there was a reduction then P= NP.

Problem 8.3. Vertex cover reduces to Efficient Recruiting. At each ode is a counselor. The edge from the node is the sport the counselor can over. For sports handled by a single counselor, draw an edge back to the same counselor.

We can enumerate the edges and vertexes in polynomial ($O(n)$) time. So solving the Vertex cover will result in a solution to the efficient recruiting problem.



Notice in this example, that Susan is the only counselor that can teach baseball. Thus the resulting graph *must* include Susan's node, similarity, Susan must be hired by the camp, if they wish to teach baseball. Our reduction seems robust.

Problem 8.5. $A = \{a_1, a_2, \dots, a_n\}$

$B = \{B_1, B_2, B_3 \dots\}$

Hamiltonian Circuit reduces to Hitting Set Problem.

Hamiltonian Circuit requires a path runs through all nodes of the graph once.

Each node in the hamiltonian graph replaces an object A, i.e. $a_1, a_2, \dots$. Each subset B contains the edges to connect nodes. If a hamiltonian path exists, then there is a subset B, that hits all edges in A. Also, it is trivial to see that this translation takes polynomial time. Therefore, hitting path is NP complete.

Problem 8.20. Reduce the graph coloring problem, to low diameter.

Graph coloring can be reduces in polynomial tie to the low diameter clustering problem. Vertices represent the set of points $p_1, p_2, p_3 \dots$. and the edges represent the sets $\{p_i, p_j\}$ color the nodes with k colors. Each color represents a partition set. Since the colors repeat as soon as possible, without being adjacent, the partition set will be as small a diameter as possible, and overall a minimum.

Translating the sets to nodes, and edges takes liner time, and thus is polynomial.

Problem Set Partitioning. subset sum $\leq_p$ Set Partition

Problem 0-1 integer programming. 3 SAT $\leq_p$ 0-1 integer programming Let integers be a set $\{i_1, i_2, i_n\}$.

Boolean values correspond to integer values of 0 or 1.

Let all correspond to $(x_1, x_2, x_n <=> i_1, i_2, i_3)$

For each truth clause we setup a corresponding inequality. For example, the truth clause $x_1 + \bar{x_2} + x_3$ we translate to $i_1 + (1 - i_2) + i_3 \geq 1$. For each not we subtract the factor from 1. In this way we can represent all boolean clauses as