Combinatorial Optimization

Greedy Algorithms

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§ Week X §

Problem 1: Optimal Cuts

Consider the polytope P defined by the following system:

$$7x_1 - 2x_2 \leq 14, \tag{1.1}$$
$$3x_2 \leq 10, \tag{1.2}$$
$$2x_1 - 2x_2 \geq 3, \tag{1.3}$$
$$x_1, x_2 \geq 0 \tag{1.4}$$
$$\tag{1.5}$$

1. Visualize the region described by this polytope;
2. List all possible solution;
3. Is this region convex? Justify your answer.

Problem 2: Ain't nobody messing with cliques

Given a tree $T = (V, E)$, find the maximum clique of the tree using an efficient greedy algorithm. What is the complexity of such algorithm.

Problem 3: Goes around the road

A railroad path has been constructed, but station locations have not been chosen yet. For our purposes, imagine the railroad as a number line, with some points on the line marked as town locations. Our job is to choose specific points on the line to build train stations; stations need not be collocated with towns, but can be if desired. Every town must be within distance R of a train station. The goal of the algorithm is to find a minimal collection of locations to build train stations.

- We'll say a train station S adds a town T if the town T is within R distance of S and T is not already within R distance of a previously chosen train station. Consider the following algorithm: until all towns are added, repeatedly build train stations where you can maximize the number of towns added. Convince me that this algorithm is incorrect.

- Design a greedy algorithm to solve this problem.

Problem 4: Back to the books

Propose a strategy to solve the knapsack problem using greedy methods.

	HP	Hunger Games	LotR	PJ&O	ATTWN	maximal weight
weight	4g	3g	8g	8g	1g	10g
value	2	4	2	2	5	-