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CSCE686 - Dr. Lamont

Spr 2020 - Homework 1

**Exercise 1.1 Related problems to maximum clique.** Given an undirected graph

G = (V,E). A clique Q of the graph G is a subset of V where any two vertices in Q

are adjacent:

∀i, j ∈ Q × Q, (i, j) ∈ E

A maximum clique is a clique with the largest cardinality. The problem of finding the

maximum clique is NP-hard. The clique number is the cardinality of the maximum

clique. Given the following problems:

• The subset I ⊆ V ofmaximumcardinality such as the set of edges of the subgraph

induced by I is empty.

• Graph coloring.

Find the relationships between the formulated problems and the maximum clique

problem. How these problems are identified in the literature?

**Exercise 1.2 Easy versus hard optimization problem.** Let us consider the set

bipartitioning problem. Given a set X of n positive integers e1, e2, . . . , en where n is

an even value. The problem consists in partitioning the set X into two subsets Y and

Z of equal size. How many possible partitions of the set X exist?

Two optimization problems may be defined:

• Maximum set bipartitioning that consists in maximizing the difference between

the sums of the two subsets Y and Z.

• Minimum set bipartitioning that consists in minimizing the difference between

the sums of the two subsets Y and Z.

To which complexity class the two optimization problems belong? Let us consider

the minimum set bipartitioning problem. Given the following greedy heuristic: sort

the set X in decreasing order. For each element of X[i] with i = 1 to n, assign it to the

set with the smallest current sum. What is the time complexity of this heuristic?