Tackling Difficult Problems: A Practical Example
Due 22 October 2003

Dominating Set
Input: A graph $G = < V, E >$ and an integer $k$.
Question: Does $V$ contain a subset $S$ of size at most $k$ that dominates all of $V$, where $v \in V$ is said to be dominated by $S$ if either $v$ is in $S$ or $v$ is adjacent to at least one element of $S$.

Sample Applications
Analysis of Gene Regulatory Networks
Analysis of Metabolic Pathways
Analysis of Protein Spectral Data

On Finding Exact Solutions
Propose: An algorithm for dominating set that is guaranteed to return optimal (minimal) solutions.
Determine: A worst-case bound on your algorithm’s run time.
Code: Your algorithm.
Experiment and Test: Using data sets to be provided. (Assume DIMACS input format.)
Based on Testing Estimate: Your algorithm’s average run time.

On Finding Approximate Solutions
Propose: An algorithm for dominating set that returns approximate solutions in polynomial time.
Determine: A worst-case bound on your algorithm’s run time and a worst-case bound on the quality of your algorithm’s solutions relative to optimal solutions.
Code: Your algorithm.
Experiment and Test: Using data sets to be provided. (Assume DIMACS input format.)
Based on Testing Estimate: Your algorithm’s average run time and solution quality.