Techniques for Dealing with NP Complete Problems

Winter 2023

While general efficient solutions to NP-Complete problems are often difficult to find, there are several methods that can be used to solve them in practice.

1 Intelligent Exhaustive Search

If guaranteeing the right answer is important, an exhaustive search may be necessary. However, one can often use techniques like backtracking and branch and bound to do substantially better than a fully exhaustive search.

2 Solving Special Cases

While some problems might be intractable for general inputs, if the inputs you expect to see are nice in some way, there may still be efficient algorithms that work on these particular inputs. We saw this for example with the polynomial time algorithm for maximum independent set if the input graph was a tree, or for knapsack when the capacity was small.

3 Heuristic Search

If getting the exact answer is not a requirement heuristic search often yields pretty good answers. Methods like hill climbing, simulated annealing and genetic algorithms often give fairly good results.

4 Approximation Algorithms

For some problems one can even find approximation algorithms that are guaranteed to find results not too much worse than the optimal answers within a reasonable amount of time.