Avi Swartz

An Attempted Polynomial Solution to an NP Problem

The purpose of this project was to create a method for solving a NP problem in Polynomial time. The NP problem that was studied was: “Given n students, select k, so that no two students form one of the p predetermined forbidden pairs.” A computer program was written to execute the method. The method used for solving this NP problem was a systematic (depth first) search, with a modification so that it would only select students if they did not form a forbidden pair with anybody already in the selection.

For this problem, the complexity value was deemed to be the number of possibilities needed to be tested in order to find the answer. The worst case complexity was exactly the same as a brute force systematic search, meaning it is not polynomial. The best case complexity was 1. However, the average time complexity was too complicated to be calculated analytically, so a Monte Carlo (random sampling and interpretation) method was implemented. The Monte Carlo method turned out to be too inconsistent to use.

Although the method described above was not a complete success, it is a good starting point that can be improved upon. This method is not better than brute force when sample size gets large, but it is better for many cases with small sample size. The methods used to make the program more efficient for a smaller sample size can be applied to other algorithms to make them more efficient.