CSI 5165 Combinatorial Algorithms   Winter 2021
Computer Science   University of Ottawa

Homework Assignment #3- PART A (50 points, weight 7.5%)
Suggested completion: Tuesday March 16; Due: Thursday March 18, 2021 (11:55PM)

Guidelines for programming parts: Write your program in some high level programming language such as C, C++, Java, python, etc. In your assignment write up give the algorithm pseudocode (similar format as in lecture notes), any algorithm explanation, table of results and a sample of results, where applicable. Hand in the program in a separate file, so it can be run if necessary, or be consulted if needed. However, the pseudocode and explanations in the writeup should be enough for understanding your algorithms, correctness and efficiency. Please, specify the platform you run your tests on (machine speed, machine RAM and operating system).

1. **Heuristic searches for Maximum cliques**

   (a) (25 points) Develop a hill-climbing algorithm, a simulated annealing algorithm, a tabu search algorithm and a genetic algorithm for the Maximum Clique problem (the problem of finding a clique of maximum cardinality in a graph).

   Before giving the **pseudocode** for each algorithm, describe your choices for neighbourhood function, profit, etc. as well as mating scheme, mutation, etc. for the case of genetic algorithm. If some of these features are common to more than one algorithm, please explain them only once, indicating in which algorithms they will be used.

   For each algorithm, write a paragraph explaining which parameter variations you recommend to be tried in order to experiment with each algorithm.

   You will be marked for clarity, conciseness, and quality of algorithm design. I expect to assign approx 15 points for HC+SA+TS and 10 points for genetic algorithm.

   (b) (25 marks) Choose 2 of the 4 algorithms developed for A2-Q3 and implement them.
   Use your algorithm to try to find maximum cliques for each of the 6 given graphs. For each graph and each algorithm, experiment with several parameter variations for the algorithm, and provide a table summarizing your results (tabulate time, number of iterations, largest clique found, etc for each algorithm and parameter variation considered). Write a conclusion based on your experiments.