CSI 5165 Combinatorial Algorithms — Winter 2009
Computer Science — University of Ottawa

Homework Assignment #3 (100 points, weight 15%)
Due: Thursday, March 26, at 8:50 a.m. (in lecture)

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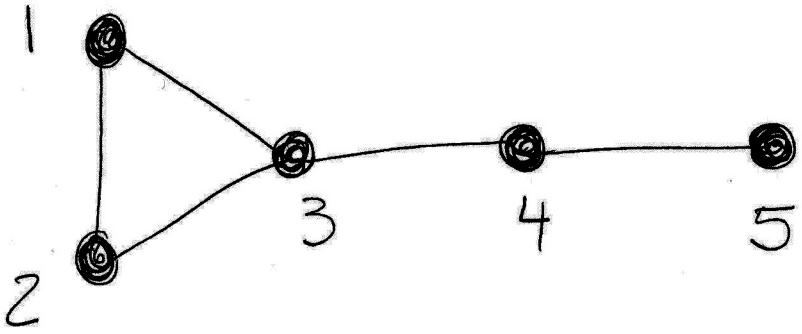
1. (40 marks) Choose one of the last 3 algorithms developed for A2-Q3 (tabu search, simulated annealing or genetic algorithm) and implement it (provide a copy of the pseudocode and description used: a copy of the corresponding answer to the A2-Q3 or a revised pseudocode, if applicable).
   Use your algorithm to try to find maximum cliques in each of the graphs given in Exercise 4.9 of the textbook. For each graph, experiment with several parameter variations for your algorithm, and provide a table summarizing your results (tabulate time, number of iterations, largest clique found, etc for each parameter variation considered).

2. (10 marks) Exercise 7.2 page 275 (simulate by hand, like in Examples 7.2, 7.3).

3. (10 marks) Exercise 7.3 page 275 (simulate by hand, like in Examples 7.4, 7.5).

4. (20 marks) Show the state space tree that results from running Algorithm 7.8 CERT1() on the following graph. At each node of the state space tree, show the original ordered partition and the ordered partition after running REFINE() and the result of Res. For leaves of the state space tree, also show Num.



5. (20 marks) Consider the following set system $\mathcal{S} = (V, \mathcal{B})$, with $V = \{1, 2, 3, 4\}$ and $\mathcal{B} = \{A = \{1, 2, 3\}, B = \{1, 2, 4\}, C = \{1, 3, 4\}\}$.

   (a) (3 marks) Represent $\mathcal{S}$ as a coloured graph.

   (b) (14 marks) Show the state space tree that results from running Algorithm 7.8 CERT1() on the graph obtained in part (a). Please, display similar information as specified in exercise 4.

   (c) (3 marks) How can you find the automorphisms of $\mathcal{S}$ from these computations? How many are there?