

Homework Assignment #3 (100 points, weight 15%)
Due: Tuesday, November 24 (in lecture)

1. (50 points) **Knapsack: hill-climbing and genetic algorithm**

Develop a hill-climbing algorithm and a genetic algorithm for the knapsack (optimization) problem.

For each algorithm, do the following:

- A. Describe the main features of your design. For hill-climbing describe the neighbourhood function and neighbourhood search algorithm. For genetic algorithm, describe recombination, selection of mating pairs and mutation algorithm.
- B. Describe your heuristic search algorithm.
- C. Implement your algorithm (to be included in an appendix).
- D. Test your algorithms with the instances given in Table 5.2 and 5.5 of the textbook. Display your results in tables, testing various values for each parameter in your algorithm and keeping similar statistics as the ones in tables 5.3, 5.4 and 5.6. How do your algorithms compare with results of Algorithms 5.20 and 5.21 given in the tables mentioned above?

2. (10 points) **Finding isomorphism by hand**

Do exercise 7.1 of the textbook.

3. (10 points) **Certificate for trees**

Do exercise 7.2 of the textbook. Simulate the algorithm by hand computation, showing your tree and labels at each step.

4. (10 points) **Reverse the certificate for a tree**

Do exercise 7.3 of the textbook. Show how the tree is built step by step.

5. (20 points) **Certificate for graphs**

Apply Algorithm 7.8 by hand, in order to compute a certificate for the following graph. Show your backtracking tree. (Note that before the first branch is explored, there is a call to procedure REFINE).

