Second problem set

Due date: 2019.02.21, 9.00

Topic: simple genetic algorithms

You have to send your solutions via email (evolalghf@gmail.com). You have to solve them unassisted, unless it's marked with a star. The problems marked * can be solved in groups of two. You can get maximum 10 points.

1. (4 points) Let us suppose, that an algorithm's running time is polynomial, that is cn^α for some $\alpha, c \in \mathbb{R}$ constants. Give an estimate for c and α if for input lengths $n = [4, 5, 6, 7, 8, 9, 10]$ we measured the following running times [37.1 58.7 84.0 115.1 150.8 190.9 235.2].

2. (6 points) Let us suppose, that we have a population containing 4 individuals called e_1, e_2, e_3, e_4. Their fitness's are $0.4, 0.7, 0.3, 0.05$. We use a roulette-wheel selection to select the four parents.

   a, What is the probability, that e_2 won't be chosen as parent at all?

   b, What is the probability, that e_3 will be chosen two times?

   Answer these two questions for $f(e)$ and also for the scaled $\hat{f}(e) = f^2(e)$ fitness function.

3. * (10 points)

   What can be a good measure of performance for a genetic algorithm? Justify your answer! Using your measure find the optimal probability of the mutation for the backpacking problem, using elitism, a tournament selection with $k = 4$, a fitness function described in the first lecture (sum of the values if the sum of the weights is below or equal to the capacity, 0 otherwise). Is there a significant difference in the efficiency between the optimal parameter and setting the probability of mutation to 0?