Assignment 4

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1. (2 marks) Given the goal of maximizing the fitness function $f(x) = x^2$ and a population of three individuals with values $x = 1, x = 2, x = 3$.
   A) Calculate selection probabilities for fitness proportional selection for these individuals.
   B) For the same individuals, calculate the selection probabilities for a transposed fitness function $f'(x) = f(x) + 10$.

2. (3 marks) A generational GA has a population size of 100, uses fitness proportional selection without elitism, and after t generations has a mean population fitness of 76.0. Fitness is to be maximized. There is <u>one</u> copy of the current best member, which has fitness 157.0.

   A) What is the expectation for the number of copies of the best individual present in the mating pool (same size as the population)?
   B) What is the probability that there will be <u>no</u> copies of that individual in the mating pool, if selection is implemented using the roulette wheel algorithm?
   C) What is the probability if the implementation uses multi-pointer selection?

3. (5 marks) Design (without actual coding) a Genetic Algorithm for a variant of the SUDOKU puzzle of variable size N x N. Initial conditions of the puzzle should be a distribution of numbers that respect the rule that in each of the N sub-squares each integer $1, ..., N$ appears only once (see figure for an example 4x4 SUDOKU puzzle).

A) (1.5 marks) representation
B) (1.5 marks) fitness function
C) (1 mark) mutation
D) (1mark) crossover

	1		3
3			
			2
2		4	