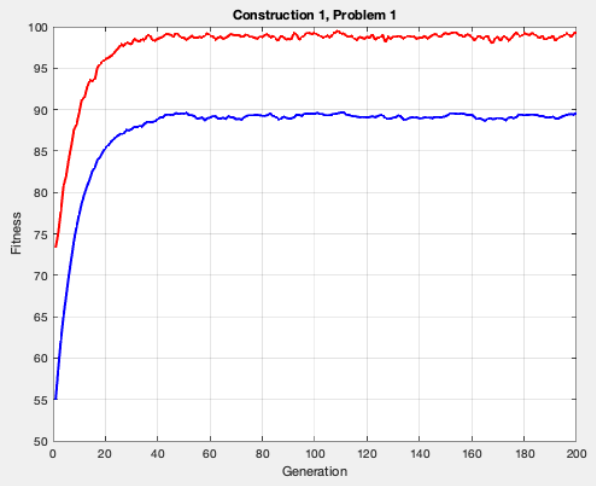
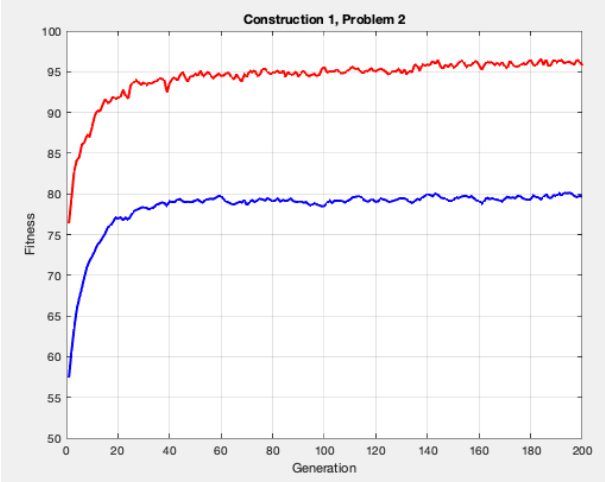
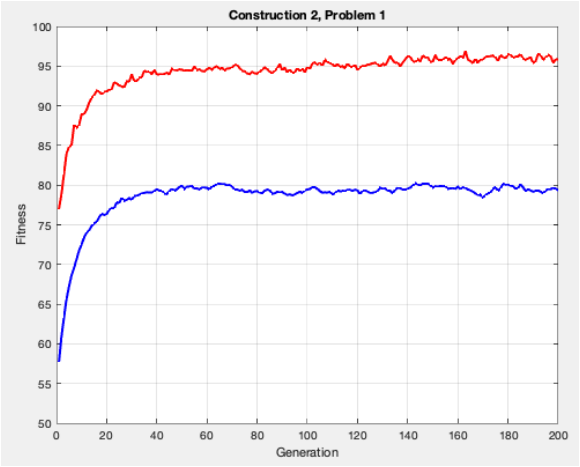
CSE/ECE848
HA4 Solution

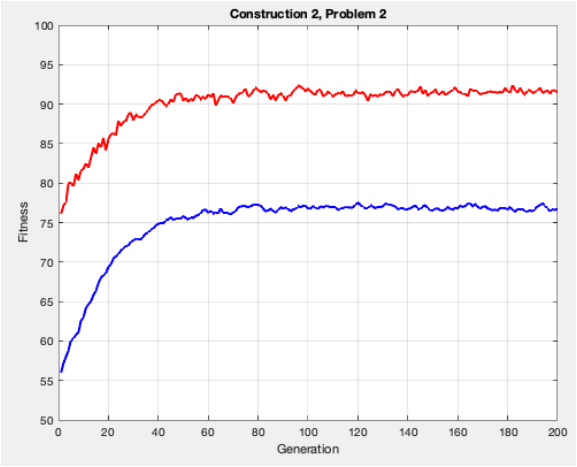
Best and Average Fitness:
Construction 1 for Problems 1 and 2:





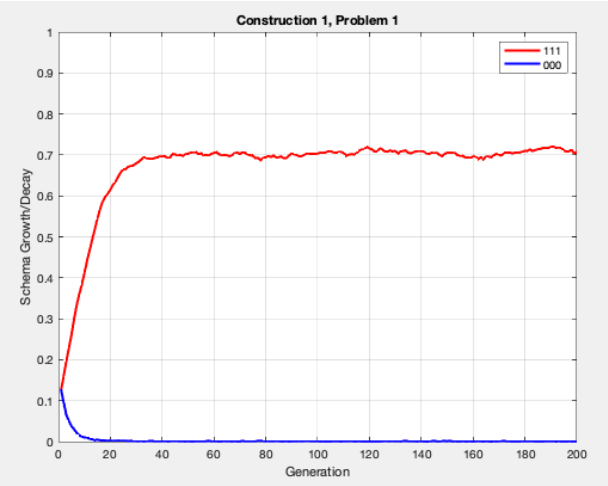
In the above two plots, average of Best (red) and Average (blue) population fitness are plotted for 30 runs.
With construction 1, best and average fitness of 30 runs grow steadily and best fitness reaches very close to the optimal fitness of 100.00. For problem 2, the growth of global schema '111' is hampered somewhat due to a highly competitive schema '000'. The average performance is also poor for problem 2. Interestingly, some runs were not able to find the best fitness (100.00).

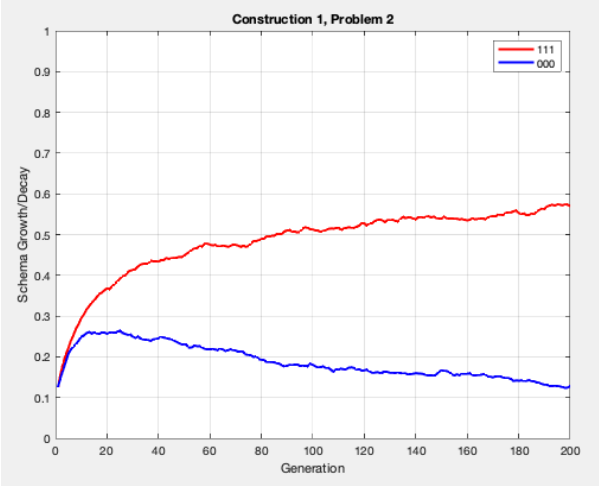




While the problem was solved with construction 2 as well, the performance is worse than with construction 1. Construction 2 for problem 2 performs the worst and best fitness hovers around 90.00 (local optimal fitness value).

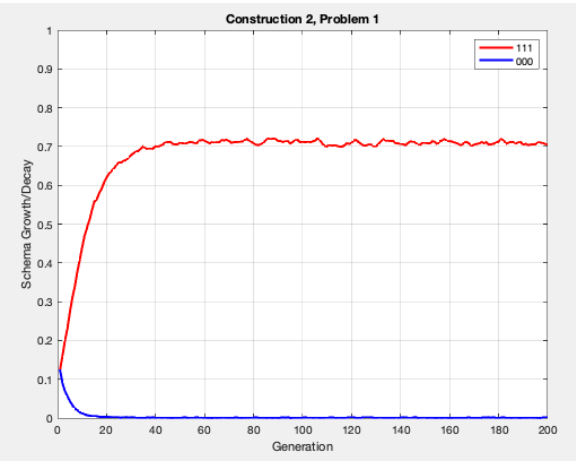
Schema growth/decay plots are shown below.
Construction 1 for Problems 1 and 2:

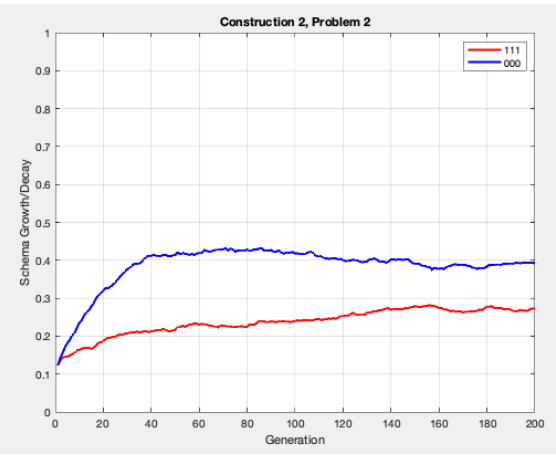




Average schema growth of each 3-bit building blocks for 30 runs are shown above. It is clear that schema '111' grows and '000' loses with generations. This is expected in both problems as '111' has the higher fitness and the coding is tight. But notice that in Problem 2, the competitor '000' tends to increase along with '111', but eventually BGA can figure out that '111' is better and grows its number with iteration. Clearly, '000' and '111' had a competion in the early generations and then '111' started to win over. The tight coding helped '111' building block. The reason for less than 100% '111' schema in problem 1 is that the next best schema '110' is also good and some of it are present in the solutions. IN problem 2, both '111' and '000' together covers about 70% of the populations and the remaining 6 competitors share the remaining 40%. The mutation operator helps to create other schema partitions.

Construction 2 for Problems 1 and 2:





For problem 1, construction 2's loose building blocks does not change the schema growth. They grow similarly as with Construction 1. But for problem 2, construction 2 makes '000' to win, despite it having a smaller fitness. BGA ends up finding the local optimal solution. Again, about 70% population shares these two schemata.

For construction 2, defining length of the building blocks were quite large and hence it was difficult to maintain ‘111’ building blocks.

These exercise indicates the importance of representation in GAs. A tight coding (if possible to obtain) for a problem incongruent to the recombination/mutation operators will help solve problems better. Also note that despite all these apparent difficulties, how a standard BGA is smart enough to solve simpler problems (problem 1) irrespective of tight or loose codings.