CS 461 - ARTIFICIAL INTELLIGENCE

Assignment 01

Deadline: 5th May 2021 11:50 p.m.

Question 1: Exploring a Simple Genetic Algorithm

In this assignment you will design and implement a simple genetic algorithm and explore its performance in evolving solution to one numerical problem, investigating the effect that various parameters have on its performance.

1. Design and implement a simple genetic algorithm, in a language of your choice, to work on binary strings, and show its performance on the Max-1s problem where the aim is to get a chromosome of all 1s. Use an 8-bit chromosome and, when calculating the fitness, map the binary number onto an integer first; so the maximum fitness for an 8-bit chromosome is 255 which is the ideal case to reach.

2. Explore the performance of the algorithm as a function of population size and number of generations. Min and max number of population size to explore performance can be of your choice for e.g. min 4 and max 10.

3. Then increase the chromosome length and investigate/explore performance as a function of this length.

By explore I mean you need to create a report in which graphs should be drawn to show how performance has varied with respect to population size, number of generations and chromosome length separately.

Bear in mind that you will be using random number generators and that, to get a representative performance and results that are statistically significant, you will need to run each experiment several times.

Question 2: N-Queens using backtracking

N-Queens problem: There is an n x n grid where the value of n is 4≤n≤8 (user shall be asked at run time for the value of n he wants to keep). Your task is to place n queens on this board. As per the rules of chess, a queen should have no other queen in its respective column, neither should it have any other queen in its row nor should it have any within its diagonal cells. You can consider this case as placing each queen individually per column such that it does not violate any of the constraints mentioned. It's quite easy to find solution manually but your task is now to code it and find the correct positions for the queens.

This problem has to be solved through the concept of backtracking. So initially you will place the first queen randomly at any location within column 1. With respect to its location, now next n-1 queens' domain i.e. the places where they can be placed might shrink up.

E.g. in this case 4 queens have to placed and Q1 is placed on (0,0) so x positions represent the illegal places now where other queens cannot be placed due to Q1 placement. This means for rest of the queens some positions have been considered as illegal.

Q1	x	x	x
X	x		
X		x	
x			X

Further up, when we will move forward, there might be a point where domain gets empty for any particular queen, at that instance apply backtrack concept, which means that location of previous queen will have to get changed.

<u>Advise</u>: Start building up your logic first on 4 queen problem so that you may exactly understand the flow then go for making a generalized code version of n queens' placement.

Q3: Map Coloring using MRV and MCV

Use Map given below and Assign colors using MRV and Degree Heuristic (MCV) Approach

<u>**You are free to use any language. Comments your code where necessary to make it clean and clear.**</u>