

CSE 440 – Artificial Intelligence  
Fall 2020  
Mid Term, Mark - 60

Each question bears 20 marks.

- For the following sudoku problem represent the initial state, goal state and operators. Write program in pseudo code to solve the problem applying backtracking DFS search. You are not allowed to apply any heuristic.

**Sudoku Problem Description:** Sudoku is a puzzle played on a partially filled 9 x 9 grid. The task is to complete the assignment using numbers from 1 to 9 such that the entries in each row, each column and each major 3 x 3 block are pairwise different. Initial board is given below, where some entries will be already filled up. You need to solve the puzzle and finally come up with the solved board. There will be multiple solutions, you need to show the first one only.

5	3			7				
6			1	9	5			
	9	8					6	
8				6				3
4			8		3			1
7				2				6
	6					2	8	
			4	1	9			5
				8			7	9

A sudoku puzzle...

5	3	4	6	7	8	9	1	2
6	7	2	1	9	5	3	4	8
1	9	8	3	4	2	5	6	7
8	5	9	7	6	1	4	2	3
4	2	6	8	5	3	7	9	1
7	1	3	9	2	4	8	5	6
9	6	1	5	3	7	2	8	4
2	8	7	4	1	9	6	3	5
3	4	5	2	8	6	1	7	9

...and its solution numbers marked in red

Initial board

solved board

- Given a target string, the goal is to produce target string starting using genetic algorithm, from a set of random strings of the same length. The string comprise of characters from A .. Z only.

Capital letter only.

Target example string (LENGTH 20): SDFLKAJFLDSAFTERWYTA

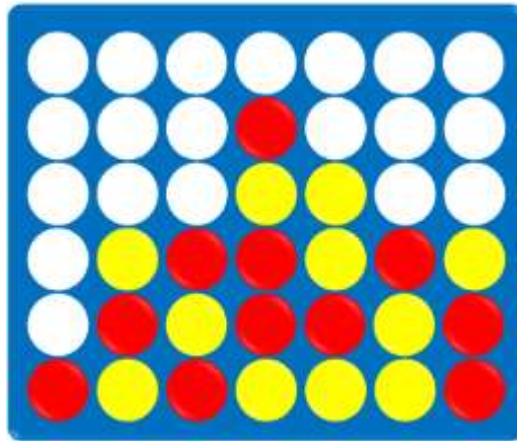
Answer the following:

- What is the size of whole population? Explain your answer. 3
- How many individual strings you like to take as initial population? Give sample of those individual strings. 3
- Write the pseudocode of genetic algorithm steps. 3
- Write the crossover, mutation and fitness function for this problem. 3+2+3
- Why genetic algorithm will produce the target string? If not, then explain what string you will get and why? 3

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3. Develop a program in pseudo code to solve the two player game Connect 4.

**Connect 4 game description:** Connect Four is a two-player connection board game, in which the players choose a color and then take turns dropping colored discs into a seven-column, six-row vertically suspended grid. The pieces fall straight down, occupying the lowest available space within the column. The objective of the game is to be the first to form a horizontal, vertical, or diagonal line of four of one's own discs.



Connect 4 game board