



Student Name: _____

Roll No: _____

Program: CS-18 A&B

Semester: SPRING – 2021

Time Allowed: 20:00 minutes

Course: Artificial Intelligence (CS 401 & 461)

Examination: MOCK

Total Marks: **60** Weightage: **30**

Date: 20/05/2021

Instructor: Dr. Hafeez ur Rehman

NOTE: Attempt all questions. Distribute your time according to question's overall weightage.

Time Allowed: 20 minutes

Submissions after 20 minutes will not be accepted.

Question # 03:

[Marks: 20]

Consider the 5-Queen problem that you would like to solve using Genetic Algorithms. Each queen can only move in its column. The idea is to find a configuration in which no queen attacks the other. A random configuration of the problem is shown below:

[Marks Distribution: 4+4+8+2+2]

	Q2			
			Q4	
				Q5
Q1				
		Q3		

In the above context answer the following:

- a. How will you turn it into a maximization problem? Write objective function.

For maximization problem we will look for the non-attacking queen pairs and will try to maximize it. Thus, the objective function will be: $f(n)$ = The number of non-attacking queen pairs in a state.

- b. What will be the maximum fitness value that your algorithm will try to achieve?

The maximum fitness value will be the maximum number of non-attacking queen pairs. Thus, for 5 queens the maximum value (pairs) will be 5C_2 , which is equal to 10.

- c. Start with a random population of **four individuals** and list the steps involved using Genetic Algorithm (allowed modification operators are crossover and mutation) in generating the first generation of states?

See lecture notes for a similar example (Slide 53 of the Lecture Set 06). If any problem or confusion, then ask me.

- d. What will happen if the mutation probability is set to 0?

The mutation operator controls the state space exploration. If probability is zero then exploration will stop and your search will be in a local region of the state space which may lead to Local Maxima problem.

e. What will happen if we avoid doing crossover?

The Crossover is a convergence operator. If we don't do crossover then the solution will not converge towards the optimal state. The genetic algorithm without crossover will be like a random search.