### **COMSATS University Islamabad Lahore Campus**

### **Assignment III – FALL 2020**

Course Title:	Artificial	Intellige	nce		Course Code:	CSC462	Credit Hours: 3(2,1)	
Course Instructor/s:	Dr. Atifa Athar				Programme Name:	BS Computer Science		
Semester:	$7^{\text{th}}$	Batch:	FA17	Section:	A, B, C	Date:	15-12-2020	
Due on		22	-12-2020		Maximum Mai	rks:	10	
Name & Registr	ation no:	Aamna	Majid FA17-B	CS-081				

- No late submissions will be accepted.
- All assignments are required to be submitted using attached template only.

Question No. 1 Marks: 10

Solve 8-queen Problem using Genetic Algorithm. Consider minimal conflict among queens as the Fitness function

### **Solution:**

The best optimal solution is when total fitness = 28 which means there is minimal conflict among queens.

Generating initial population

### A:

3	2	7	5	2	8	6	4

Fitness = no of non-attacking pairs

					Q8		
		Q3					
						Q6	
			Q5				
							Q4
$Q_1$							
	$Q_2$			Q2			
Q <sub>1</sub>	$Q_2$			Q2			

**Queen 1:** 5

**Queen 2:** 5

**Queen 3:** 5

**Queen 4:** 4

**Queen 5:** 3

**Queen 6:** 2

**Queen 7:** 1

**Queen 8:** 0

### B:

7	2	7	5	2	4	6	1	

Q<sub>1</sub> Q<sub>3</sub> Q<sub>7</sub> Q<sub>7</sub> Q<sub>7</sub> Q<sub>4</sub> Q<sub>6</sub> Q<sub>2</sub> Q<sub>5</sub> Q<sub>8</sub>

Fitness = no of non-attacking pairs

**Queen 1:** 6

**Queen 2:** 5

**Queen 3:** 4

**Queen 4:** 3

**Queen 5:** 3

**Queen 6:** 2

**Queen 7:** 1

**Queen 8:** 0

Total fitness: 24

### C:

3	2	8	5	2	4	6	1

Fitness = no of non-attacking pairs

**Queen 1:** 6

**Queen 2:** 5

**Queen 3:** 5

**Queen 4:** 3

**Queen 5:** 3

**Queen 6:** 2

**Queen 7:** 1

**Queen 8:** 0

Total fitness: 25

# Q3 Q7 Q7 Q7 Q6 Q1 Q2 Q5 Q8

# Crossover

A:

3 2 7	5 2	8	6 4
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C:



New Population:

D:

3 2 8	5	2	8	6	4
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E:

1	6	1	2	5	7	2	3
1	U	_	_	5	′		5
	6	4	2	5	7	2	3

**Mutation:** 

F:

3	2	8	7	2	8	6	4

G:

3	2	7	5	2	4	6	8

# **Next Generation:**

### **Calculating fitness Of F:**

		Q3			Q6		
			Q4				
						Q7	
							Q8
$Q_1$							
	$Q_2$			Q5			

**Queen 1:** 5

**Queen 2:** 5

**Queen 3:** 3

**Queen 4:** 4

**Queen 5:** 3

**Queen 6:** 2

**Queen 7:** 1

**Queen 8:** 0

# Calculating fitness Of G:

3	2	7	5	2	4	6	8

							Q8
		Q3					
						Q7	
			Q4				
					Q6		
$Q_1$							
	$Q_2$			Q5			

**Queen 1:** 6

**Queen 2:** 4

**Queen 3:** 4

**Queen 4:** 4

**Queen 5:** 3

**Queen 6:** 2

**Queen 7:** 1

**Queen 8:** 0

Total fitness: 24

### **Crossover:**

C:

3	2	8	5	2	4	6	1

F:

3 2 8	7	2	8	6	4
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# New Population:

H:

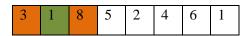
3	2	8	5	2	4	6	1

I:

3	2	8	7	2	8	6	4
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# **Mutation:**

J:



K:

3	2	1	7	2	8	6	4

# **Next generation:**

	-
U	

3	1	8	5	2	4	6	1

		Q3					
						Q7	
			Q4				
					Q6		
Q <sub>1</sub>							
				Q5			
	$Q_2$						Q8

**Queen 1:** 7

**Queen 2:** 4

**Queen 3:** 5

**Queen 4:** 3

**Queen 5:** 3

**Queen 6:** 2

**Queen 7:** 1

**Queen 8:** 0

Total fitness: 25

### K:

3	2	1	7	2	8	6	4

					Q6		
			Q4				
						Q7	
							Q8
$Q_1$							
	$Q_2$			Q5			
		Q3					

**Queen 1:** 5

**Queen 2:** 4

**Queen 3:** 5

**Queen 4:** 4

**Queen 5:** 3

**Queen 6: 2** 

**Queen 7:** 1

**Queen 8:** 0

# Crossover

J:

3	1	8	5	2	4	6	1
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K:

3	2	1	7	2	8	6	4	

New Population:

L:

3	2	8	5	2	4	6	1	_
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M:

1								
	3	1	1	7	2	8	6	4

**Mutation:** 

N:

3 4	8	5	2	4	6	1
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O:

5	1	1	7	2	Q	6	1
5	1	1	′		O	U	_

# **Next generation:**

N:

3	4	8	5	2	4	6	1

		Q3					
						Q7	
			Q4				
	$Q_2$				Q6		
$Q_1$							
				Q5			
							Q8

**Queen 1:** 6

**Queen 2:** 5

**Queen 3:** 5

**Queen 4:** 3

**Queen 5:** 3

**Queen 6:** 2

**Queen 7:** 1

**Queen 8:** 0

O:

5	1	1	7	2	8	6	4

					Q6		
			Q4				
						Q7	
$\mathbf{Q}_1$							
							Q8
				Q5			
	$Q_2$	Q3					

**Queen 1:** 7

**Queen 2:** 4

**Queen 3:** 5

**Queen 4:** 4

**Queen 5:** 3

Queen 6: 2

**Queen 7:** 1

**Queen 8:** 0

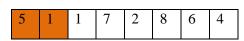
Total fitness: 26

Crossover

K:

3	2	1	7	2	8	6	4

O:



P:

5	1	1	7	2	8	6	4

Q:

3	2	1	7	2	8	6	4
					_	_	

**Mutation:** 

R:

5	3	1	7	2	8	6	4

S:

	5	2	1	7	2	8	6	4	
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# Calculating Fitness of R:

5 3 1 7 2 8 6	4
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					Q6		
			Q4				
						Q7	
$\mathbf{Q}_1$							
							Q8
	$Q_2$						
				Q5			
		Q3					

**Queen 1:** 7

**Queen 2:** 6

**Queen 3:** 5

**Queen 4:** 4

**Queen 5:** 3

**Queen 6:** 2

**Queen 7:** 1

**Queen 8:** 0

Total fitness: 28

# **Required Fitness Solution:**

5 3 1	7 2	8	6	4
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