

EC-350 AI and Decision Support Systems
Assignment# 2
Genetic Algorithm

Deadline: Wed, 30 Oct 2024, 2359 hrs

The assignment is divided into 2 parts. The first part is the implementation of the problem and the second part is to be done on the solution sheet.

Part I:

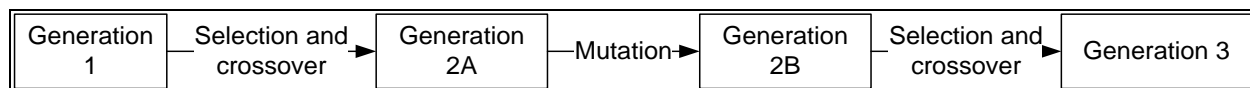
Write a script (program) to solve the 5 antenna problem explained below using Genetic Algorithm. Randomly generate a population of 20 individuals/chromosomes. Evaluate their fitness and then select, crossover and mutate. Run it for many generations/iterations until you find the individual with best/maximum fitness.

Part II:

We have to place **5 antennas (a,b,c,d,e)** on a 6x6 grid in such a way that maximum area is covered by their signals. To find the best solution we use Genetic algorithm, upon a population of three individuals/chromosomes.

You are provided with initial 3 chromosomes (on page3) .

Follow the steps in the figure below for the selection, mutation and fitness evaluation to find the best solution. Fill the provided sheet (page 3), with respective values, and shade the grid as well.



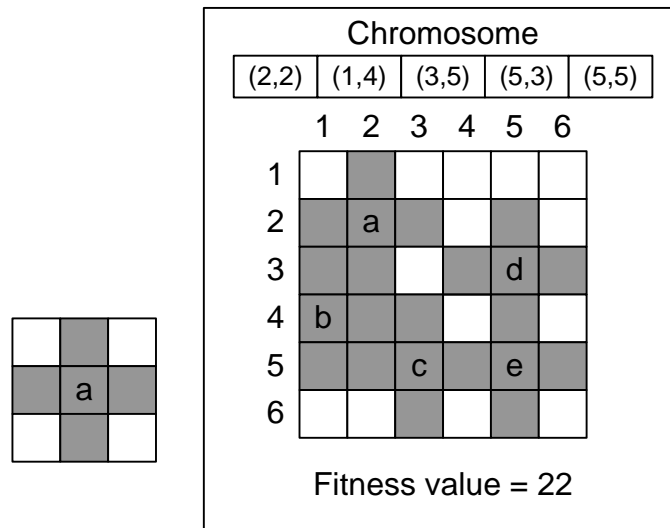
Chromosome:

The chromosome has 5 values, each representing the position of antenna (a,b,c,d,e) consecutively, on the grid. For example, the below chromosome shows the positions of a,b,c,d,e as shown. x is horizontal, and y is vertical.

Chromosome						
(2,2)	(1,4)	(3,5)	(5,3)	(5,5)		
	1	2	3	4	5	6
1						
2		a				
3					d	
4	b					
5			c		e	
6						

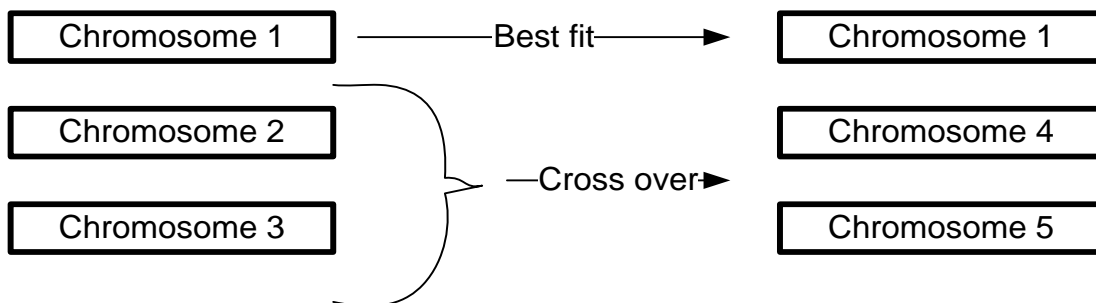
Fitness evaluation:

Each antenna covers 5 blocks on a grid. One its own, and four neighbours, up, down, left and right. So fitness value is the total area covered by all 5 antennas. Example is shown below. 5 antennas cover 22 blocks, so fitness value is 22.



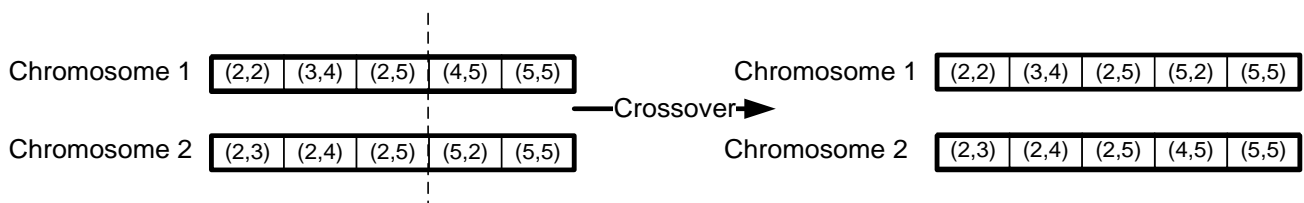
Selection:

When the fitness value of all three chromosomes is calculated, we select the worst 2 chromosomes for cross over while the best chromosome passes to next generation as it is.



Crossover:

Crossover takes place between sections (a,b,c) and (d,e), as shown in figure.



Mutation:

ONLY the worst chromosome is mutated out of the three. For mutation ALL the antennas, move upwards, i.e. their y value is decremented by 1.

Generation 1

Chromosome Alpha													
(2,2)	(1,4)	(3,5)	(4,6)	(5,6)									
1	2	3	4	5	6	x							
1													
2													
3													
4													
5													
6													
y Fitness value = ____													

Chromosome Beta													
(2,3)	(3,5)	(2,6)	(5,3)	(5,5)									
1	2	3	4	5	6	x							
1													
2													
3													
4													
5													
6													
y Fitness value = ____													

Chromosome Gamma													
(2,3)	(2,4)	(2,5)	(5,2)	(5,5)									
1	2	3	4	5	6	x							
1													
2													
3													
4													
5													
6													
y Fitness value = ____													

Generation 2 A Generation 2 B

Chromosome Alpha													
1	2	3	4	5	6	x							
1													
2													
3													
4													
5													
6													
y Fitness value = ____													

Mutated Chromosome													
1	2	3	4	5	6	x							
1													
2													
3													
4													
5													
6													
y Fitness value = ____													

Best 1													
1	2	3	4	5	6	x							
1													
2													
3													
4													
5													
6													
y Fitness value = ____													

Best 2													
1	2	3	4	5	6	x							
1													
2													
3													
4													
5													
6													
y Fitness value = ____													

Chromosome Gamma													
1	2	3	4	5	6	x							
1													
2													
3													
4													
5													
6													
y Fitness value = ____													

Generation 3

Chromosome Alpha													
1	2	3	4	5	6	x							
1													
2													
3													
4													
5													
6													
y Fitness value = ____													

Chromosome Beta													
1	2	3	4	5	6	x							
1													
2													
3													
4													
5													
6													
y Fitness value = ____													

Chromosome Gamma													
1	2	3	4	5	6	x							
1													
2													
3													
4													
5													
6													
y Fitness value = ____													

Solution to be filled here