University of Central Punjab

Assignment-3

Artificial Intelligence (Spring2023) :

Marks: 60

Date: 6-6-2023 **Due Date: 12-12-2023**

Question-1

Following are the initial population of 8-queen problem:

Chromosomes	
X1	5 6 7 1 5 3 8 2
X2	4 8 7 6 5 4 1 1
X3	8 7 6 3 5 7 8 7
X4	7 4 7 5 8 1 2 2

Evaluate the fitness of each individual, showing all your workings, and arrange them in order with the fittest first and the least fit last.

a) Perform the following crossover operations:
   I. Cross the fittest two individuals using one–point crossover at the middle point.
   II. Cross the second and third fittest individuals using a two–point crossover (points b and f).
   III. Cross the first and third fittest individuals (ranked 1st and 3rd) using a uniform crossover.

b) Suppose the new population consists of the six offspring individuals received by the crossover operations in the above question. Evaluate the fitness of the new population, showing all your workings. Has the overall fitness improved?

c) By looking at the fitness function and considering that genes can only be digits between 1 and 8, find the chromosome representing the optimal solution (i.e. with the maximum fitness). Find the value of the maximum fitness.

Solve the 8x8 queen problem using Genetic algorithm (Follow all required steps) and check if the new generation is optimal.

Question-2

Solve the TSP using GA and perform determine the third generation.

(Note: Generate any random population with 9 cities and perform all steps as in Q.1)

Question-3

Question: Maximize the Knapsack and determine which items should be present in it. Calculate the fitness and determine the next generation.

a) Perform one point crossover on the extreme right gene of the chromosomes
b) For the mutation, swap the extreme bits

Item Table

Item	Weight (KG)	Price ($)
A	5	12
B	3	5
C	7	10
D	2	7

Initial Population

	A	B	C	D	
C1	0	1	1	0	**6**
C2	0	1	0	1	**5**
C3	1	1	0	1	**13**
C4	1	1	1	1	**15**

Gene: **0** represents absence of item
Gene:**1** represents presence of item