1. Consider the tabu search algorithm for a Travelling Salesperson Problem with 5 cities based on the neighbourhood defined by the 2-swap mapping. The frequency based memory is given by the following table.

	2	3	4	5	
	0	2	3	3	1
		2	1	3	2
			2	3	3
				1	4

   How many times was city 4 swapped with another city in the last 20 iterations? Justify your answer.

2. Consider the basic representation of genetic algorithms and the bit strings $Parent_1 = 1010101010$ and $Parent_2 = 1001001001$. Apply a one-point crossover between the fifth and sixth bit. What are the children (or offsprings) of this crossover?

3. Consider the genetic algorithm for a Traveling Salesperson problem with 7 cities and the tours

position	1	2	3	4	5	6	7
tour	3	6	4	5	7	1	2

position	1	2	3	4	5	6	7
tour	5	2	7	3	4	6	1

   given by the path representation. Find an offspring of these tours for the alternative edge crossover of their adjacency representation. Show the offspring by using both the adjacency and path representations.

4. Consider the genetic algorithm for a Traveling Salesperson problem with 7 cities and the tours

position	1	2	3	4	5	6	7
tour	5	3	4	1	2	7	6

position	1	2	3	4	5	6	7
tour	2	1	7	6	5	4	3

   given by the path representation. Do a one-point crossover with the cutting point between positions 3 and 4 of the ordinal representations of the tours. Show the offsprings of the tours by using the path representation.

5. Consider the genetic algorithm for a Travelling Salesperson problem with 7 cities and the tours

position	1	2	3	4	5	6	7
tour	3	6	4	5	7	1	2

position	1	2	3	4	5	6	7
tour	5	2	7	4	3	6	1

   given by the path representation. Find two offspring of these tours for the cycle crossover.