Faculty of Engineering & Technology Electrical & Computer Engineering Department

ARTIFICIAL INTELLIGENCE - ENCS3340

#Porject1: Optimizing Job Shop Scheduling in a Manufacturing Plant using Genetic Algorithm

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Sec: 1

Date: 20/5/2024

Abstract:

The aim of this project is to crate algorithm to solve the problems in the real life, distributes the project on the Job scheduling, and the goal is to use the genetic algorithm and try to distribute the Jobs based on the available machines in the work space as much as possible, the evaluation based on the accuracy this is mean to get the least time consuming schedule for the jobs presented.

Contents

Introduction:

Genetic Algorithm search is a heuristic search, it based on the idea of natural selection and genetics, and these are intelligent exploitation of random search provided with historical data to direct the search into the region of better performance in solution space. They are commonly used to generate high-quality solutions for optimization problems and search problems.

Formulation:

Genetic algorithm:

Genetic algorithms are considered as a search process used in computing to find exact or an approximate solution for optimization and search problems. There are also known as local search algorithm. These techniques are inspired by evolutionary biology such as inheritance mutation, selection and cross over. These algorithms provide a technique for program to automatically improve their parameters in order to find the best solution for the problem.

Genetic algorithm procedure can be divided into:

1. Creating an initial population:

Creating an initial population depends on the problem formulation, what does the population means? How to introduce the data as chromosomes to proceed with the algorithm?

Data presentation:

In our problem we presented the data read as a gene that describes the jobs and their machines and the needed time for the machine to do the job, to deal with the gene, we presented a object that describes the tasks of a job and takes the needed parameters for the job read from a *.txt* file.

Chromosome presentation:

The chromosome represent a schedule for the entire jobs tasks that we have in our *.txt* file (genes) that we save their objects in a big array called "filedata" to hold the genes.

In order to create the chromosomes we have to randomly append the genes in the "filedata" array while keeping track of the constrains that describes that the tasks should be appended sequentially and we can start with any job we want.

2. Apply the fitness function:

The fitness function describes the performance of the schedule "chromosomes" which describes the execution of the tasks "jobs on the available machines" and keeping track of the waiting time for the chromosome the waiting time is the calibration to differentiate a chromosome among the others.

3. Selection of the next generation parents:

After the calibration ends for all the available generated chromosomes we present a random waiting time weight for the chromosomes depending on the performance the best waiting time have a high weight which indicates that the chances of choosing it is higher and the weight of the worst chromosome is the lightest which means it have a weaker chance to choose it but the selection remains random for all the chromosomes.

4. Cross-over to create the children:

After the selection we take the parents (the randomly chosen chromosomes after the calibration) and then we apply a cross-over on a random point to create the children.

5. Mutate a random child:

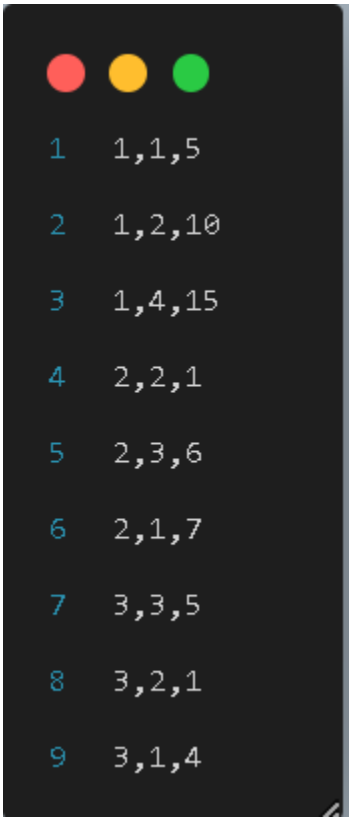
We take a random child from the children and then we have a randomly generated chance to do the mutation on it and the mutation in our case is to swap a random two genes together.

6. Create the next generations from these children:

After we have the generated child's from the cross-over and mutation we have a calibration for the child's if they are better we choose them if they are worse we remain with the parents

Test cases:

The contents of the jobs.txt file:



The output:

We ran the program to generate 10 chromosomes ad apply the genetic algorithm for 10 generations:

We will present 3 generations from the output.

Initial generation generated:

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Please enter the number of chromosomes for the initial generation: 10
Please enter the number of generations to generate: 10
Chromosome : [(2, 2, 1), (3, 3, 5), (1, 1, 5), (1, 2, 10), (2, 3, 6), (3, 2, 1), (3, 1, 4), (1, 4, 15), (2, 1, 7)]
Chromosome : [(3, 3, 5), (1, 1, 5), (2, 2, 1), (2, 3, 6), (1, 2, 10), (3, 2, 1), (1, 4, 15), (3, 1, 4), (2, 1, 7)]
Chromosome : [(3, 3, 5), (2, 2, 1), (1, 1, 5), (2, 3, 6), (1, 2, 10), (3, 2, 1), (3, 1, 4), (2, 1, 7), (1, 4, 15)]
Chromosome : [(2, 2, 1), (1, 1, 5), (3, 3, 5), (3, 2, 1), (1, 2, 10), (2, 3, 6), (1, 4, 15), (2, 1, 7), (3, 1, 4)]
Chromosome : [(2, 2, 1), (1, 1, 5), (3, 3, 5), (1, 2, 10), (3, 2, 1), (2, 3, 6), (1, 4, 15), (2, 1, 7), (3, 1, 4)]
Chromosome : [(3, 3, 5), (2, 2, 1), (1, 1, 5), (1, 2, 10), (3, 2, 1), (2, 3, 6), (2, 1, 7), (1, 4, 15), (3, 1, 4)]
Chromosome : [(2, 2, 1), (3, 3, 5), (1, 1, 5), (2, 3, 6), (1, 2, 10), (3, 2, 1), (3, 1, 4), (2, 1, 7), (1, 4, 15)]
Chromosome : [(2, 2, 1), (3, 3, 5), (1, 1, 5), (3, 2, 1), (1, 2, 10), (2, 3, 6), (1, 4, 15), (3, 1, 4), (2, 1, 7)]
Chromosome : [(3, 3, 5), (1, 1, 5), (2, 2, 1), (2, 3, 6), (1, 2, 10), (3, 2, 1), (1, 4, 15), (2, 1, 7), (3, 1, 4)]
Chromosome : [(3, 3, 5), (1, 1, 5), (2, 2, 1), (1, 2, 10), (2, 3, 6), (3, 2, 1), (3, 1, 4), (2, 1, 7), (1, 4, 15)]
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Generation1:

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\\\\\\\\\\\\\\\\\\\\\\Generation : 1\\\\\\\\\\\\\\\\\\\\\\\\

================================================== Waiting time for the chromosomes ==================================================

Chromosome 1: [(2, 2, 1), (1, 1, 5), (3, 3, 5), (3, 2, 1), (2, 3, 6), (1, 2, 10), (2, 1, 7), (3, 1, 4), (1, 4, 15)] - Waiting Time: 21
Chromosome 2: [(3, 3, 5), (1, 1, 5), (2, 2, 1), (1, 2, 10), (2, 3, 6), (3, 2, 1), (2, 1, 7), (1, 4, 15), (3, 1, 4)] - Waiting Time: 39
Chromosome 3: [(3, 3, 5), (2, 2, 1), (1, 1, 5), (3, 2, 1), (2, 3, 6), (1, 2, 10), (1, 4, 15), (3, 1, 4), (2, 1, 7)] - Waiting Time: 18
Chromosome 4: [(1, 1, 5), (2, 2, 1), (3, 3, 5), (3, 2, 1), (2, 3, 6), (1, 2, 10), (1, 4, 15), (3, 1, 4), (2, 1, 7)] - Waiting Time: 18
Chromosome 5: [(3, 3, 5), (1, 1, 5), (2, 2, 1), (3, 2, 1), (1, 2, 10), (2, 3, 6), (3, 1, 4), (2, 1, 7), (1, 4, 15)] - Waiting Time: 18
Chromosome 6: [(3, 3, 5), (2, 2, 1), (1, 1, 5), (1, 2, 10), (3, 2, 1), (2, 3, 6), (2, 1, 7), (1, 4, 15), (3, 1, 4)] - Waiting Time: 39
Chromosome 7: [(3, 3, 5), (1, 1, 5), (2, 2, 1), (3, 2, 1), (2, 3, 6), (1, 2, 10), (2, 1, 7), (1, 4, 15), (3, 1, 4)] - Waiting Time: 21
Chromosome 8: [(1, 1, 5), (3, 3, 5), (2, 2, 1), (2, 3, 6), (1, 2, 10), (3, 2, 1), (3, 1, 4), (1, 4, 15), (2, 1, 7)] - Waiting Time: 36
Chromosome 9: [(1, 1, 5), (3, 3, 5), (2, 2, 1), (1, 2, 10), (2, 3, 6), (3, 2, 1), (1, 4, 15), (2, 1, 7), (3, 1, 4)] - Waiting Time: 39
Chromosome 10: [(2, 2, 1), (3, 3, 5), (1, 1, 5), (3, 2, 1), (1, 2, 10), (2, 3, 6), (1, 4, 15), (2, 1, 7), (3, 1, 4)] - Waiting Time: 21

================================================== Sorted chromosomes by waiting time ==================================================

Chromosome: [(3, 3, 5), (2, 2, 1), (1, 1, 5), (3, 2, 1), (2, 3, 6), (1, 2, 10), (1, 4, 15), (3, 1, 4), (2, 1, 7)] - Waiting Time: 18
Chromosome: [(1, 1, 5), (2, 2, 1), (3, 3, 5), (3, 2, 1), (2, 3, 6), (1, 2, 10), (1, 4, 15), (3, 1, 4), (2, 1, 7)] - Waiting Time: 18
Chromosome: [(3, 3, 5), (1, 1, 5), (2, 2, 1), (3, 2, 1), (1, 2, 10), (2, 3, 6), (3, 1, 4), (2, 1, 7), (1, 4, 15)] - Waiting Time: 18
Chromosome: [(2, 2, 1), (1, 1, 5), (3, 3, 5), (3, 2, 1), (2, 3, 6), (1, 2, 10), (2, 1, 7), (3, 1, 4), (1, 4, 15)] - Waiting Time: 21
Chromosome: [(3, 3, 5), (1, 1, 5), (2, 2, 1), (3, 2, 1), (2, 3, 6), (1, 2, 10), (2, 1, 7), (1, 4, 15), (3, 1, 4)] - Waiting Time: 21
Chromosome: [(2, 2, 1), (3, 3, 5), (1, 1, 5), (3, 2, 1), (1, 2, 10), (2, 3, 6), (1, 4, 15), (2, 1, 7), (3, 1, 4)] - Waiting Time: 21
Chromosome: [(1, 1, 5), (3, 3, 5), (2, 2, 1), (2, 3, 6), (1, 2, 10), (3, 2, 1), (3, 1, 4), (1, 4, 15), (2, 1, 7)] - Waiting Time: 36
Chromosome: [(3, 3, 5), (1, 1, 5), (2, 2, 1), (1, 2, 10), (2, 3, 6), (3, 2, 1), (2, 1, 7), (1, 4, 15), (3, 1, 4)] - Waiting Time: 39
Chromosome: [(3, 3, 5), (2, 2, 1), (1, 1, 5), (1, 2, 10), (3, 2, 1), (2, 3, 6), (2, 1, 7), (1, 4, 15), (3, 1, 4)] - Waiting Time: 39
Chromosome: [(1, 1, 5), (3, 3, 5), (2, 2, 1), (1, 2, 10), (2, 3, 6), (3, 2, 1), (1, 4, 15), (2, 1, 7), (3, 1, 4)] - Waiting Time: 39
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================================================== The selected parents ==================================================

Parent 1: [(1, 1, 5), (3, 3, 5), (2, 2, 1), (2, 3, 6), (1, 2, 10), (3, 2, 1), (3, 1, 4), (1, 4, 15), (2, 1, 7)] - Waiting Time: 36
Parent 2: [(1, 1, 5), (3, 3, 5), (2, 2, 1), (1, 2, 10), (2, 3, 6), (3, 2, 1), (1, 4, 15), (2, 1, 7), (3, 1, 4)] - Waiting Time: 39
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The cross_point is: 4

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Child 1: [(1, 1, 5), (3, 3, 5), (2, 2, 1), (1, 2, 10), (1, 2, 10), (3, 2, 1), (3, 1, 4), (1, 4, 15), (2, 1, 7)]
Child 2: [(1, 1, 5), (3, 3, 5), (2, 2, 1), (2, 3, 6), (2, 3, 6), (3, 2, 1), (1, 4, 15), (2, 1, 7), (3, 1, 4)]
========================================== Selected child for mutation ==========================================
Selected child: [(1, 1, 5), (3, 3, 5), (2, 2, 1), (1, 2, 10), (1, 2, 10), (3, 2, 1), (3, 1, 4), (1, 4, 15), (2, 1, 7)]

The selected genes to swap are: gene1: 7 and gene2: 0
================================================ Mutated child ================================================
Mutated child: [(1, 4, 15), (3, 3, 5), (2, 2, 1), (1, 2, 10), (1, 2, 10), (3, 2, 1), (3, 1, 4), (1, 1, 5), (2, 1, 7)]



childs have been added seccsfully


\\\\\\\\\\\\\\\\\\\\\\Generation : 2\\\\\\\\\\\\\\\\\\\\\\\\
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Generation2:

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\\\\\\\\\\\\\\\\\\\\\\\Generation : 2\\\\\\\\\\\\\\\\\\\\\\\\

================================================== Waiting time for the chromosomes ==================================================

Chromosome 1: [(3, 3, 5), (1, 1, 5), (2, 2, 1), (1, 2, 10), (2, 3, 6), (3, 2, 1), (2, 1, 7), (1, 4, 15), (3, 1, 4)] - Waiting Time: 39
Chromosome 2: [(3, 3, 5), (2, 2, 1), (1, 1, 5), (3, 2, 1), (2, 3, 6), (1, 2, 10), (1, 4, 15), (3, 1, 4), (2, 1, 7)] - Waiting Time: 18
Chromosome 3: [(1, 1, 5), (2, 2, 1), (3, 3, 5), (3, 2, 1), (2, 3, 6), (1, 2, 10), (1, 4, 15), (3, 1, 4), (2, 1, 7)] - Waiting Time: 18
Chromosome 4: [(3, 3, 5), (1, 1, 5), (2, 2, 1), (3, 2, 1), (1, 2, 10), (2, 3, 6), (3, 1, 4), (2, 1, 7), (1, 4, 15)] - Waiting Time: 18
Chromosome 5: [(3, 3, 5), (2, 2, 1), (1, 1, 5), (1, 2, 10), (3, 2, 1), (2, 3, 6), (2, 1, 7), (1, 4, 15), (3, 1, 4)] - Waiting Time: 39
Chromosome 6: [(3, 3, 5), (1, 1, 5), (2, 2, 1), (3, 2, 1), (2, 3, 6), (1, 2, 10), (2, 1, 7), (1, 4, 15), (3, 1, 4)] - Waiting Time: 21
Chromosome 7: [(1, 1, 5), (3, 3, 5), (2, 2, 1), (2, 3, 6), (1, 2, 10), (3, 2, 1), (3, 1, 4), (1, 4, 15), (2, 1, 7)] - Waiting Time: 36
Chromosome 8: [(1, 1, 5), (3, 3, 5), (2, 2, 1), (1, 2, 10), (2, 3, 6), (3, 2, 1), (1, 4, 15), (2, 1, 7), (3, 1, 4)] - Waiting Time: 39
Chromosome 9: [(1, 4, 15), (3, 3, 5), (2, 2, 1), (1, 2, 10), (1, 2, 10), (3, 2, 1), (3, 1, 4), (1, 1, 5), (2, 1, 7)] - Waiting Time: 48
Chromosome 10: [(1, 1, 5), (3, 3, 5), (2, 2, 1), (2, 3, 6), (2, 3, 6), (3, 2, 1), (1, 4, 15), (2, 1, 7), (3, 1, 4)] - Waiting Time: 31

================================================== Sorted chromosomes by waiting time ==================================================

Chromosome: [(3, 3, 5), (2, 2, 1), (1, 1, 5), (3, 2, 1), (2, 3, 6), (1, 2, 10), (1, 4, 15), (3, 1, 4), (2, 1, 7)] - Waiting Time: 18
Chromosome: [(1, 1, 5), (2, 2, 1), (3, 3, 5), (3, 2, 1), (2, 3, 6), (1, 2, 10), (1, 4, 15), (3, 1, 4), (2, 1, 7)] - Waiting Time: 18
Chromosome: [(3, 3, 5), (1, 1, 5), (2, 2, 1), (3, 2, 1), (1, 2, 10), (2, 3, 6), (3, 1, 4), (2, 1, 7), (1, 4, 15)] - Waiting Time: 18
Chromosome: [(3, 3, 5), (1, 1, 5), (2, 2, 1), (3, 2, 1), (2, 3, 6), (1, 2, 10), (2, 1, 7), (1, 4, 15), (3, 1, 4)] - Waiting Time: 21
Chromosome: [(1, 1, 5), (3, 3, 5), (2, 2, 1), (2, 3, 6), (2, 3, 6), (3, 2, 1), (1, 4, 15), (2, 1, 7), (3, 1, 4)] - Waiting Time: 31
Chromosome: [(1, 1, 5), (3, 3, 5), (2, 2, 1), (2, 3, 6), (1, 2, 10), (3, 2, 1), (3, 1, 4), (1, 4, 15), (2, 1, 7)] - Waiting Time: 36
Chromosome: [(3, 3, 5), (1, 1, 5), (2, 2, 1), (1, 2, 10), (2, 3, 6), (3, 2, 1), (2, 1, 7), (1, 4, 15), (3, 1, 4)] - Waiting Time: 39
Chromosome: [(3, 3, 5), (2, 2, 1), (1, 1, 5), (1, 2, 10), (3, 2, 1), (2, 3, 6), (2, 1, 7), (1, 4, 15), (3, 1, 4)] - Waiting Time: 39
Chromosome: [(1, 1, 5), (3, 3, 5), (2, 2, 1), (1, 2, 10), (2, 3, 6), (3, 2, 1), (1, 4, 15), (2, 1, 7), (3, 1, 4)] - Waiting Time: 39
Chromosome: [(1, 4, 15), (3, 3, 5), (2, 2, 1), (1, 2, 10), (1, 2, 10), (3, 2, 1), (3, 1, 4), (1, 1, 5), (2, 1, 7)] - Waiting Time: 48
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================================================== The selected parents ==================================================

Parent 1: [(3, 3, 5), (2, 2, 1), (1, 1, 5), (3, 2, 1), (2, 3, 6), (1, 2, 10), (1, 4, 15), (3, 1, 4), (2, 1, 7)] - Waiting Time: 18
Parent 2: [(1, 1, 5), (3, 3, 5), (2, 2, 1), (2, 3, 6), (1, 2, 10), (3, 2, 1), (3, 1, 4), (1, 4, 15), (2, 1, 7)] - Waiting Time: 36
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The cross_point is: 8

==========================================================================================================================
Child 1: [(1, 1, 5), (3, 3, 5), (2, 2, 1), (2, 3, 6), (1, 2, 10), (3, 2, 1), (3, 1, 4), (1, 4, 15), (2, 1, 7)]
Child 2: [(3, 3, 5), (2, 2, 1), (1, 1, 5), (3, 2, 1), (2, 3, 6), (1, 2, 10), (1, 4, 15), (3, 1, 4), (2, 1, 7)]
========================================== Selected child for mutation ==========================================
Selected child: [(3, 3, 5), (2, 2, 1), (1, 1, 5), (3, 2, 1), (2, 3, 6), (1, 2, 10), (1, 4, 15), (3, 1, 4), (2, 1, 7)]

The selected genes to swap are: gene1: 2 and gene2: 7
================================================ Mutated child ================================================
Mutated child: [(3, 3, 5), (2, 2, 1), (3, 1, 4), (3, 2, 1), (2, 3, 6), (1, 2, 10), (1, 4, 15), (1, 1, 5), (2, 1, 7)]



childs have been added seccsfully


\\\\\\\\\\\\\\\\\\\\\\\Generation : 3\\\\\\\\\\\\\\\\\\\\\\\\
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Generation3:

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\\\\\\\\\\\\\\\\\\\\\\Generation : 3\\\\\\\\\\\\\\\\\\\\\\\\

================================================== Waiting time for the chromosomes ==================================================

Chromosome 1: [(3, 3, 5), (2, 2, 1), (1, 1, 5), (3, 2, 1), (2, 3, 6), (1, 2, 10), (1, 4, 15), (3, 1, 4), (2, 1, 7)] - Waiting Time: 18
Chromosome 2: [(1, 1, 5), (2, 2, 1), (3, 3, 5), (3, 2, 1), (2, 3, 6), (1, 2, 10), (1, 4, 15), (3, 1, 4), (2, 1, 7)] - Waiting Time: 18
Chromosome 3: [(3, 3, 5), (1, 1, 5), (2, 2, 1), (3, 2, 1), (1, 2, 10), (2, 3, 6), (3, 1, 4), (2, 1, 7), (1, 4, 15)] - Waiting Time: 18
Chromosome 4: [(3, 3, 5), (2, 2, 1), (1, 1, 5), (1, 2, 10), (3, 2, 1), (2, 3, 6), (2, 1, 7), (1, 4, 15), (3, 1, 4)] - Waiting Time: 39
Chromosome 5: [(1, 1, 5), (3, 3, 5), (2, 2, 1), (2, 3, 6), (1, 2, 10), (3, 2, 1), (3, 1, 4), (1, 4, 15), (2, 1, 7)] - Waiting Time: 36
Chromosome 6: [(1, 1, 5), (3, 3, 5), (2, 2, 1), (1, 2, 10), (2, 3, 6), (3, 2, 1), (1, 4, 15), (2, 1, 7), (3, 1, 4)] - Waiting Time: 39
Chromosome 7: [(1, 4, 15), (3, 3, 5), (2, 2, 1), (1, 2, 10), (1, 2, 10), (3, 2, 1), (3, 1, 4), (1, 1, 5), (2, 1, 7)] - Waiting Time: 48
Chromosome 8: [(1, 1, 5), (3, 3, 5), (2, 2, 1), (2, 3, 6), (2, 3, 6), (3, 2, 1), (1, 4, 15), (2, 1, 7), (3, 1, 4)] - Waiting Time: 31
Chromosome 9: [(1, 1, 5), (3, 3, 5), (2, 2, 1), (2, 3, 6), (1, 2, 10), (3, 2, 1), (3, 1, 4), (1, 4, 15), (2, 1, 7)] - Waiting Time: 36
Chromosome 10: [(3, 3, 5), (2, 2, 1), (3, 1, 4), (3, 2, 1), (2, 3, 6), (1, 2, 10), (1, 4, 15), (1, 1, 5), (2, 1, 7)] - Waiting Time: 14

================================================== Sorted chromosomes by waiting time ==================================================

Chromosome: [(3, 3, 5), (2, 2, 1), (3, 1, 4), (3, 2, 1), (2, 3, 6), (1, 2, 10), (1, 4, 15), (1, 1, 5), (2, 1, 7)] - Waiting Time: 14
Chromosome: [(3, 3, 5), (2, 2, 1), (1, 1, 5), (3, 2, 1), (2, 3, 6), (1, 2, 10), (1, 4, 15), (3, 1, 4), (2, 1, 7)] - Waiting Time: 18
Chromosome: [(1, 1, 5), (2, 2, 1), (3, 3, 5), (3, 2, 1), (2, 3, 6), (1, 2, 10), (1, 4, 15), (3, 1, 4), (2, 1, 7)] - Waiting Time: 18
Chromosome: [(3, 3, 5), (1, 1, 5), (2, 2, 1), (3, 2, 1), (1, 2, 10), (2, 3, 6), (3, 1, 4), (2, 1, 7), (1, 4, 15)] - Waiting Time: 18
Chromosome: [(1, 1, 5), (3, 3, 5), (2, 2, 1), (2, 3, 6), (2, 3, 6), (3, 2, 1), (1, 4, 15), (2, 1, 7), (3, 1, 4)] - Waiting Time: 31
Chromosome: [(1, 1, 5), (3, 3, 5), (2, 2, 1), (2, 3, 6), (1, 2, 10), (3, 2, 1), (3, 1, 4), (1, 4, 15), (2, 1, 7)] - Waiting Time: 36
Chromosome: [(1, 1, 5), (3, 3, 5), (2, 2, 1), (2, 3, 6), (1, 2, 10), (3, 2, 1), (3, 1, 4), (1, 4, 15), (2, 1, 7)] - Waiting Time: 36
Chromosome: [(3, 3, 5), (2, 2, 1), (1, 1, 5), (1, 2, 10), (3, 2, 1), (2, 3, 6), (2, 1, 7), (1, 4, 15), (3, 1, 4)] - Waiting Time: 39
Chromosome: [(1, 1, 5), (3, 3, 5), (2, 2, 1), (1, 2, 10), (2, 3, 6), (3, 2, 1), (1, 4, 15), (2, 1, 7), (3, 1, 4)] - Waiting Time: 39
Chromosome: [(1, 4, 15), (3, 3, 5), (2, 2, 1), (1, 2, 10), (1, 2, 10), (3, 2, 1), (3, 1, 4), (1, 1, 5), (2, 1, 7)] - Waiting Time: 48
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================================================== The selected parents ==================================================

Parent 1: [(3, 3, 5), (2, 2, 1), (1, 1, 5), (3, 2, 1), (2, 3, 6), (1, 2, 10), (1, 4, 15), (3, 1, 4), (2, 1, 7)] - Waiting Time: 18
Parent 2: [(1, 1, 5), (2, 2, 1), (3, 3, 5), (3, 2, 1), (2, 3, 6), (1, 2, 10), (1, 4, 15), (3, 1, 4), (2, 1, 7)] - Waiting Time: 18
==========================================================================================================================

The cross_point is: 2

==========================================================================================================================
Child 1: [(1, 1, 5), (2, 2, 1), (1, 1, 5), (3, 2, 1), (2, 3, 6), (1, 2, 10), (1, 4, 15), (3, 1, 4), (2, 1, 7)]
Child 2: [(3, 3, 5), (2, 2, 1), (3, 3, 5), (3, 2, 1), (2, 3, 6), (1, 2, 10), (1, 4, 15), (3, 1, 4), (2, 1, 7)]


childs have been added seccsfully


\\\\\\\\\\\\\\\\\\\\\\Generation : 4\\\\\\\\\\\\\\\\\\\\\\\\
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