ECMM409 Coursework 1

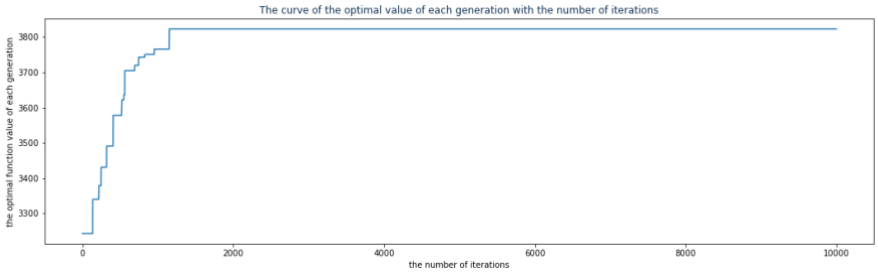
Experiment Report

Implementation and Experimentation

1. **First experiment**

   Initial parameters：gen = 10000 (Number of iterations), t = 2 (Tournament size), pm = 0.05 (Mutation rate), mu = 1 (Number of mutations), popsize=100 (Population size), n = 100 (Chromosome size), w = weight (List of weights of each bag), c = value (List of values of each),b = bag (List of number of each bag), W = 277 (Capacity limit)

   Experiment result:



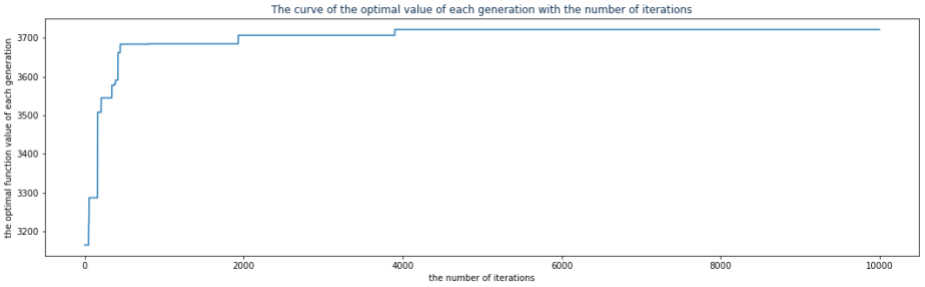
   Generation of optimal value: 1151

   Optimal value: 3823

2. **Results of different Tournament size(t)**

   t = 20, other parameters stay the same

   Experiment result:

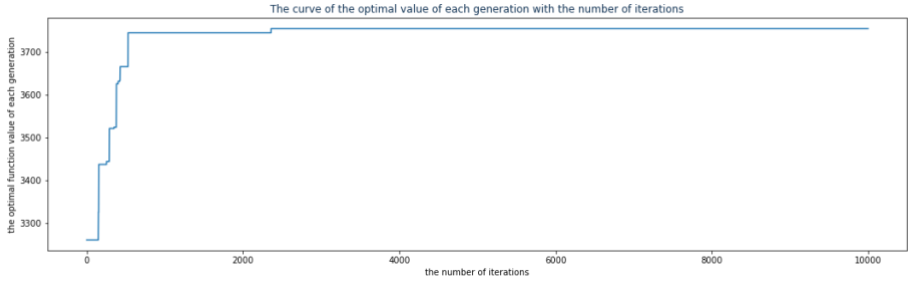


   Generation of optimal value: 3901

   Optimal value: 3722

   t = 50, other parameters stay the same

Experiment result:

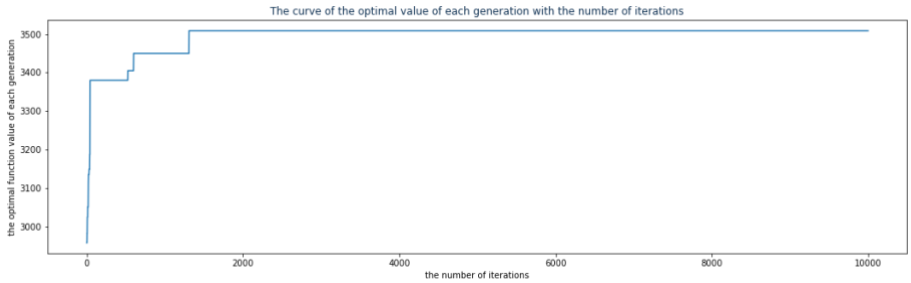


Generation of optimal value: 2360
Optimal value: 3754

According to the results of different t, when we increase the select pressure, the optimal value has not changed significantly, but converge more slowly.

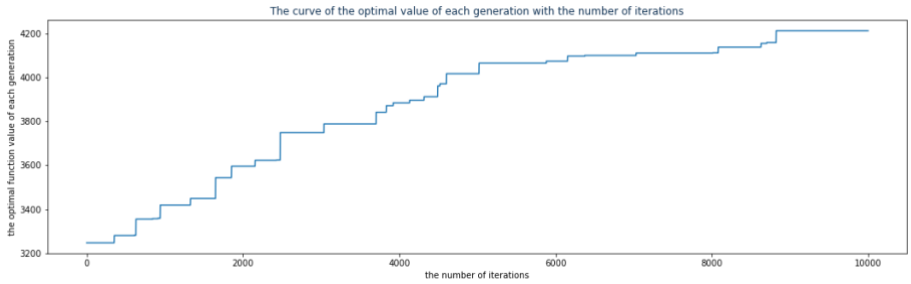
3. **Results of different Population size(popsize)**

Popsize = 20 other parameters stay the same as the first experiment.
Experiment result:



Generation of optimal value: 1310
Optimal value: 3509

Popsize = 500 other parameters stay the same as the first experiment.
Experiment result:

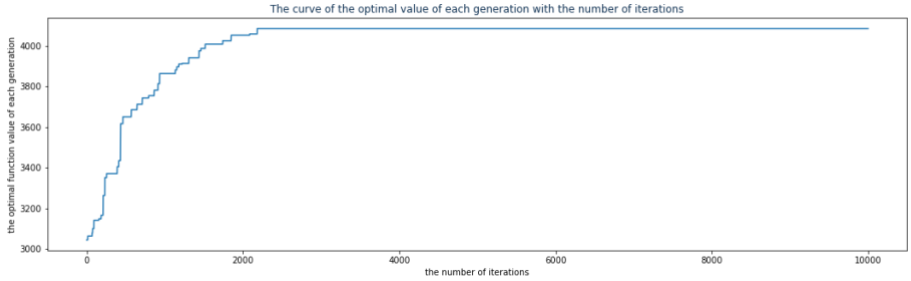


Generation of optimal value: 8824
Optimal value: 4214

4. **Results of different Mutation rate(pm)**

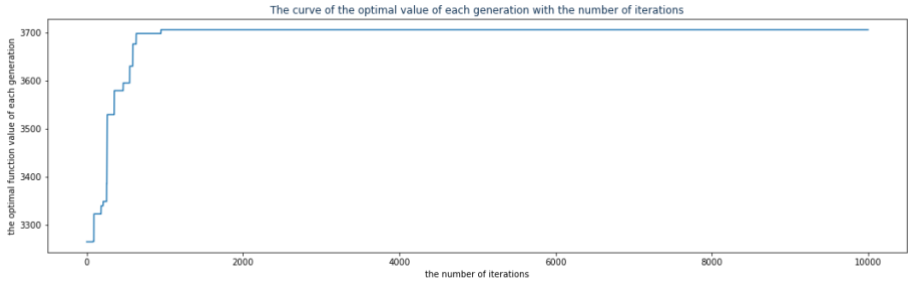
Mutation rate=1, other parameters stay the same as the first experiment.

Experiment result:



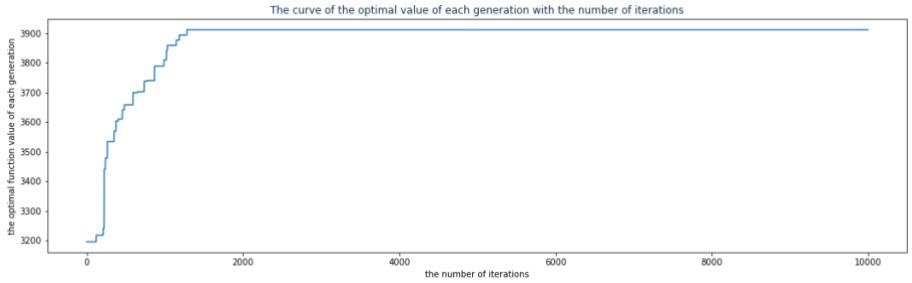
Generation of optimal value: 2182
Optimal value: 4086

Mutation rate=0.5, other parameters stay the same as the first experiment.



Generation of optimal value: 951
Optimal value: 3707

Mutation rate=0.2, other parameters stay the same as the first experiment.



Generation of optimal value: 1283
Optimal value: 3913

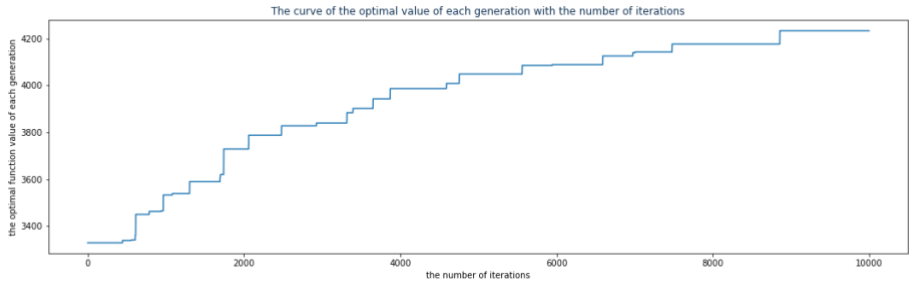
Mutation rate=0.01, other parameters stay the same as the first experiment.

Generation of optimal value: 951
Optimal value: 3707

Analysis

Question 1:

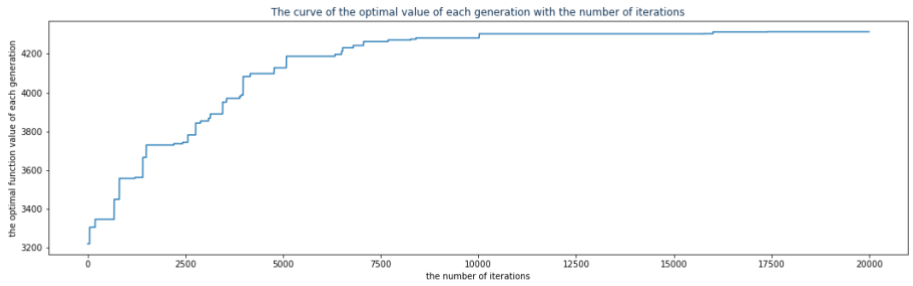
gen = 10000 (Number of iterations), t = 2 (Tournament size), pm = 0.2 (Mutation rate), mu = 1 (Number of mutations), popsize=500 (Population size), n = 100 (Chromosome size), w = weight (List of weights of each bag), c = value (List of values of each),b = bag (List of number of each bag), W = 277 (Capacity limit)



In my experiments, this combination of parameters produces the best results, which are the optimal value: 4234, generation of optimal value: 8857, the weight of the optimal value: 275.4, selected bags of this optimal value: [2, 3, 4, 5, 6, 8, 9, 11, 12, 16, 19, 20, 21, 22, 24, 25, 27, 28, 31, 32, 33, 34, 36, 38, 40, 42, 44, 45, 46, 47, 48, 50, 51, 53, 54, 57, 58, 59, 60, 61, 62, 63, 65, 66, 67, 69, 70, 73, 76, 77, 78, 81, 83, 84, 87, 89, 90, 91, 95, 96, 98, 100]

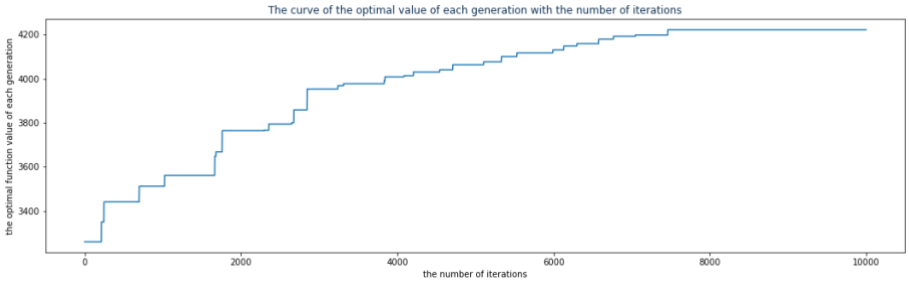
Question 2:

In this case, although we got the max value, converge too slowly, and according to the curve, we cannot rule out that 4234 is only a local optimal solution， so if increase the number of iterations, we may get better results. So, I try to change the generation number to 20000, the result is better, which is 4314 and converge in 17389th.

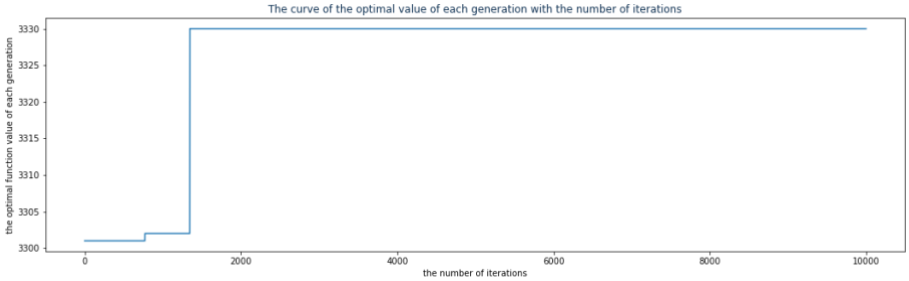


Question 3:

Base on the experiment of question 1, when I moved the mutation, set the mutation rate = 0, the results changed to the optimal value: 4222 and the generation of optimal value: 7463



when I moved the crossover, the results changed to the optimal value: 3330 and the generation of optimal value: 1345， although the convergence is fast, the result is not good.



Question 4:

If my EA needs to work with a multi-objective version of this problem, the fitness function needs to be changed, because, in this task, I directly use the value to represent the fitness, but a multi-objective task needs to combine other parameters to calculate the fitness. Such as I can use the Pareto solution to calculate the fitness based on different elements.