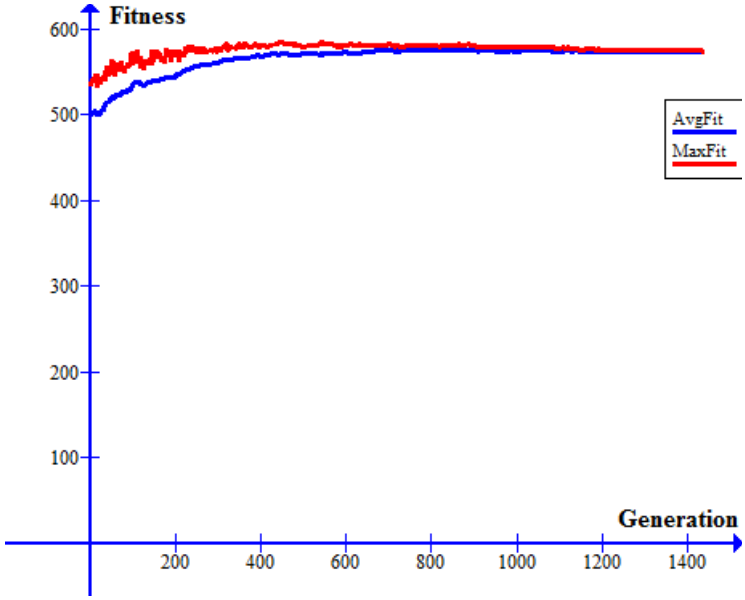
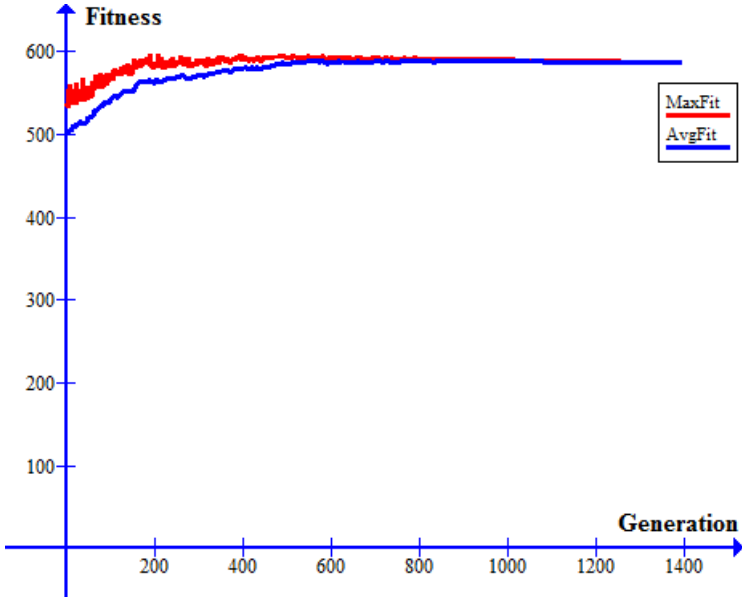
One point crossover with roulette selection



Uniform crossover with roulette selection



Source code:

generations.cs:

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;
using System.Threading.Tasks;
using System.IO;
```

```
namespace siit_1
{
    class generation
    {
        List<int[]> gens;
        List<int> fitness { get; }
        List<float> probability { get; }
        List<int> chromSelect;
        public float averagefitness = 0f;

        int rando = 0;

        public generation()
        {
            gens = new List<int[]>();
            fitness = new List<int>();
            probability = new List<float>();
            chromSelect = new List<int>();

            for (int j = 0; j < 100; j++)
            {
                int[] gen = new int[1000];
                gens.Add(gen);
                fitness.Add(0);
                probability.Add(0f);
                chromSelect.Add(0);
            }
        }

        public generation(List<int[]> new_gens)
        {
            gens = new List<int[]>();
            fitness = new List<int>();
            probability = new List<float>();
            chromSelect = new List<int>();
            gens = new_gens;
            for (int j = 0; j < 100; j++)
            {
                fitness.Add(0);
                probability.Add(0f);
                chromSelect.Add(0);
            }
        }

        public void randomize()
        {
            Random rand = new Random();
            for (int i = 0; i < 100; i++)
            {
                for (int j = 0; j < 1000; j++)
                {
```

```
            gens[i][j] = rand.Next() % 2;
        }
    }
}
public void setFitness()
{
    for (int i = 0; i < 100; i++)
    {
        for (int j = 0; j < 1000; j++)
        {
            if (gens[i][j] == 1) fitness[i] += 1;
        }
    }
}
public void setProbability()
{
    int mass = 0; ;
    for (int i = 0; i < 100; i++)
    {
        mass += fitness[i];
    }
    averagefitness = mass / 100;
    for (int i = 0; i < 100; i++)
    {
        probability[i] = (float)fitness[i] / (float)mass;
    }
}
public int[] newChild()
{

    Random rand = new Random(DateTime.Now.TimeOfDay.Milliseconds + rando);
    rando++;
    if (rando == 10000000) rando = 0;
    int rand_num = rand.Next(1000000000);
    float sum = 0f;
    int[] chrom_1 = new int[1000], chrom_2 = new int[1000];

      for(int i = 0; i < 100; i++)
      {
          sum += probability[i]* 1000000000;
          if (rand_num <= sum)
          {
              chromSelect[i]++;
              chrom_1 = gens[i];
              break;
          }

      }
    //chrom_1 = gens[rand_num];
    sum = 0f;
    rand_num = rand.Next(1000000000);
    for (int i = 0; i < 100; i++)
```

```
    {
        sum += probability[i] * 1000000000;
        if (rand_num <= sum)
        {
            chromSelect[i]++;
            chrom_2 = gens[i];
            break;
        }
    }
    //chrom_2 = gens[rand_num];



    int[] new_chrom = new int[1000];

    //unified crossover
    //for (int i = 0; i < 1000; i++)
    //{
    //    if (rand.Next() % 2 == 1) new_chrom[i] = chrom_1[i];
    //    else new_chrom[i] = chrom_2[i];
    //}

    //one point crossover
    int point = rand.Next() % 1000;
    for(int i = 0; i < 1000; i++)
    {
        if (i < point) new_chrom[i] = chrom_1[i];
        else new_chrom[i] = chrom_2[i];
    }

    return new_chrom;
}
public int bestFitness()
{
    return fitness.Max();
}

public void Sort()
{
    for (int i = 0; i < 100 - 1; i++)
    {
        bool swapped = false;
        for (int j = 0; j < 100 - i - 1; j++)
        {
            if (fitness[j] < fitness[j + 1])
            {
                int[] tmp_gen = gens[j];
                gens[j] = gens[j + 1];
                gens[j + 1] = tmp_gen;

                int tmp_fit = fitness[j];
                fitness[j] = fitness[j + 1];
```

```
                fitness[j + 1] = tmp_fit;
                swapped = true;
            }

        }
        if (!swapped) break;
      }
    }
    public float getAverageFit()
    {
      return averagefitness;
    }
    public void WriteTable(StreamWriter file1,StreamWriter file2)
    {
      for (int i = 0; i < 100; i++) {
        file1.WriteLine(chromSelect[i].ToString());
        file2.WriteLine(i.ToString());
        }
      file1.WriteLine();
      file1.WriteLine();
    }
  }
}
```

Program.cs:

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;
using System.Threading.Tasks;
using System.IO;

namespace siit_1
{
  class Program
  {
    static void Main(string[] args)
    {
      StreamWriter avgFitFile = new StreamWriter("averageFit.txt");
      StreamWriter maxFitFile = new StreamWriter("maxFit.txt");
      StreamWriter numGenFile = new StreamWriter("numGen.txt");
      StreamWriter tableFile = new StreamWriter("Table.txt");
      StreamWriter tablenum = new StreamWriter("Num.txt");
      generation old_gens = new generation();
      old_gens.randomize();
      old_gens.setFitness();
      old_gens.setProbability();
      int maxFit = 0;
      int numGeneration = 0;
      for (int j = 0; j < 1000; numGeneration++)
```

```
        {
            numGenFile.WriteLine(numGeneration.ToString());
            Console.WriteLine(old_gens.bestFitness() + " " + old_gens.getAverageFit());
            if (old_gens.bestFitness() == 1000) break;
            List<int[]> new_tmp = new List<int[]>();
            //old_gens.Sort();
            for (int i = 0; i < 100; i++)
            {
                new_tmp.Add(old_gens.newChild());
            }
            old_gens.WriteTable(tableFile,tablenum);
            generation new_gens = new generation(new_tmp);
            old_gens = new_gens;
            old_gens.setFitness();
            old_gens.setProbability();
            avgFitFile.WriteLine(old_gens.getAverageFit().ToString());
            maxFitFile.WriteLine(old_gens.bestFitness().ToString());
            if (old_gens.bestFitness() > maxFit)
            {
                maxFit = old_gens.bestFitness();
                j = 0;
            }
            else j++;

        }
        tablenum.Close();
        tableFile.Close();
        numGenFile.Close();
        avgFitFile.Close();
        maxFitFile.Close();
    }
  }
}
```