1 exercise – Zhenya Semenyuk

Conditions

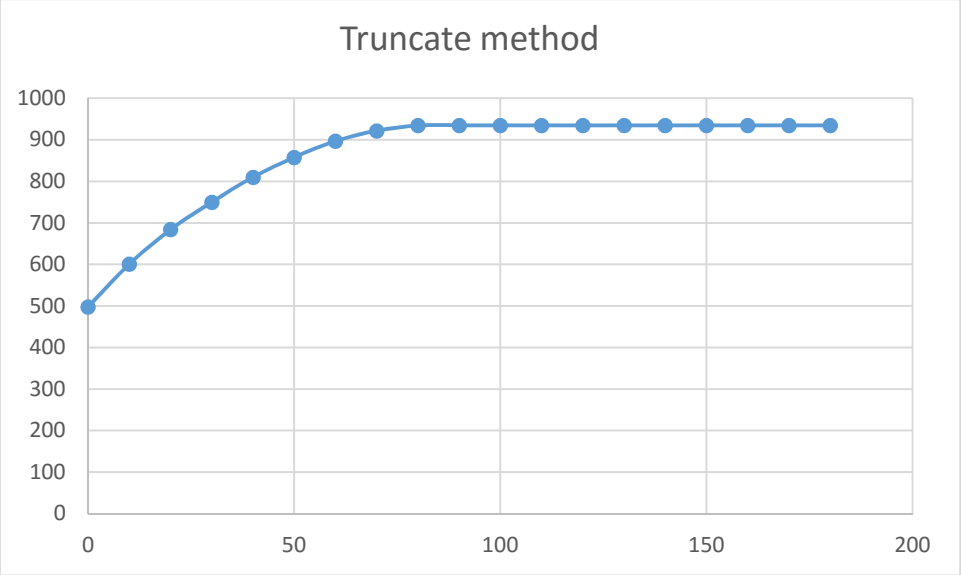
1. Create 100 random binary-chromosomes each with 1000 genes.
2. Fitness is the number of “1” in one chromosome – the more the better.
3. Select 2 chromosomes by roulette method
4. Create a child chromosome by a uniform-crossover.
5. Repeat from 2. to 5. 100 times and create the next generation.
6. Repeat 6. until the fitness value does not change any more.

Souce Code

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;
using System.Threading.Tasks;
using static Genetic.Constants;

namespace Genetic
{
    public static class Constants
    {
        public const int CHROMOSOMES_NUMBER = 100;
        public const int GENES_NUMBER = 1000;
        public const int GENERATIONS_NUMBER = 1000;
        public const int FINTESS_CHANGE_NUMBER = 100;
        public const int MUTATION = 10000;
        public const int MUTATION_BORDER = 10;
    }
}

namespace Genetic
{
    public class Chromosome : IComparable<Chromosome>
    {
        public List<int> Genes { get; set; }
        public double Fitness { get; set; }
        public double Probability { get; set; }
        readonly Random _rnd;

        public Chromosome(Random rnd)
        {
            _rnd = rnd;
            Genes = new List<int>();

            for (int i = 0; i < GENES_NUMBER; i++)
                Genes.Add(_rnd.Next(2));

            Fitness = Genes.Sum();
        }

        public int CompareTo(Chromosome compareChromosome)
        {
            if (compareChromosome == null)
                return -1;
            else
                return compareChromosome.Fitness.CompareTo(Fitness);
        }

        public Chromosome CreateChild(Chromosome parent2)
        {
```

```
            int chooseParent;

            Chromosome child = new Chromosome(_rnd);
            child.Genes.Clear();

            for(int i = 0; i < GENES_NUMBER; i++)
            {
                chooseParent = _rnd.Next(2);

                if (chooseParent == 1)
                    child.Genes.Add(Genes.ElementAt(i));
                else
                    child.Genes.Add(parent2.Genes.ElementAt(i));
            }

            child.Fitness = child.Genes.Sum();

            return child;
        }
    }
}

using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;
using System.Threading.Tasks;
using static Genetic.Constants;

namespace Genetic
{
    class Program
    {
        static void Main(string[] args)
        {
            List<Chromosome> chromosomes = new List<Chromosome>();
            List<Chromosome> childChromosomes = new List<Chromosome>();

            int generationCount = 0;
            // increment if fitness hasn't change
            int fitnessChangeCount = 0;
            double parentsFitness, childsFitness;
           // double motherProbability, FatherProbability;
            int i;

            Random rnd = new Random(DateTime.Now.TimeOfDay.Milliseconds);

            //1-st generation
            for (i = 0; i < CHROMOSOMES_NUMBER; i++)
                chromosomes.Add(new Chromosome(rnd));

            double fitnessSumm = chromosomes.Select(x => x.Fitness).Sum();

            foreach (var chr in chromosomes)
                chr.Probability = chr.Fitness / fitnessSumm;
            chromosomes.Sort();
            //1-st generation
            Console.WriteLine("Calculating...");

            Chromosome mother, father;

            while (generationCount != GENERATIONS_NUMBER)
            {
                //if (fitnessChangeCount > FINTESS_CHANGE_NUMBER)
                //    break;
```

```
                chromosomes.Sort();
                parentsFitness = chromosomes.Average(x => x.Fitness);

                if (generationCount % 100 == 0)
                    Console.WriteLine($"Generation {generationCount}: - Average fitness:
{parentsFitness}");

                //create child from 2 parents and add to the population 100 times
                for (i = 0; i < CHROMOSOMES_NUMBER; i++)
                {
                    //roulette
                    mother = ChooseParent(chromosomes, rnd);
                    father = ChooseParent(chromosomes, rnd);

                    childChromosomes.Add(father.CreateChild(mother));

                    //truncate method

//childChromosomes.Add(chromosomes.ElementAt(rnd.Next(CHROMOSOMES_NUMBER / 2))
                    //    .CreateChild(chromosomes.ElementAt(rnd.Next(CHROMOSOMES_NUMBER
/ 2))));
                }

                childsFitness = childChromosomes.Average(x => x.Fitness);

                if ((int)childsFitness == (int)parentsFitness)
                    fitnessChangeCount++;

                chromosomes.Clear();
                chromosomes.AddRange(childChromosomes);
                childChromosomes.Clear();

                fitnessSumm = chromosomes.Select(x => x.Fitness).Sum();
                foreach (var chr in chromosomes)
                    chr.Probability = chr.Fitness / fitnessSumm;



                generationCount++;
            }
        }

        public static Chromosome ChooseParent(List<Chromosome> chromosomes, Random rnd)
        {
            double probabilitySum, parentProbability;
            Chromosome parent = null;
            probabilitySum = 0.0;
            parentProbability = rnd.NextDouble();

            for (int j = 0; j < GENES_NUMBER; j++)
            {
                if (probabilitySum < parentProbability)
                    probabilitySum += chromosomes.ElementAt(j).Probability;
                else
                {
                    parent = chromosomes.ElementAt(j - 1);
                    break;
                }
            }

            return parent;
        }
    }
}
```


Truncate method
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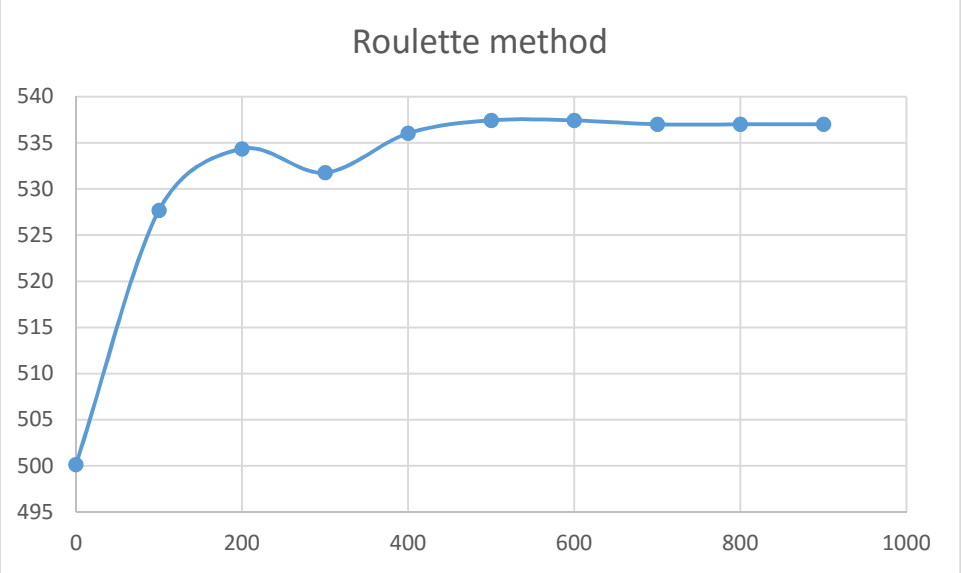
Roulette method
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