Task1

Source code:

```
import java.util.ArrayList;
import java.util.List;
import java.util.Random;
import java.util.concurrent.ThreadLocalRandom;
/**
 * Created by yauheni on 07.09.16.
 */
class Individual implements Comparable<Individual> {
	public static final int GENE_LENGTH = 20;
	private List<Double> genes;
	private double fitnessValue;
	public double getGene(int index) {
		return genes.get(index);
	}
	public void setGene(int index, double gene) {
		genes.set(index, gene);
	}
	public Individual() {
		Random r = new Random();
		genes = new ArrayList<>();
		for (int i = 0; i < GENE_LENGTH; ++i) {
			genes.add(r.nextInt(1000)/ 100.0 - 5);
		}
		fitnessValue = getFitness();
	}
	public double getFitnessValue() {
		return fitnessValue;
	}
	public void setFitnessValue(double fitnessValue) {
		this.fitnessValue = fitnessValue;
	}
	public void generateIndividual() {
	}
	public double getFitness() {
		double temp = 0.0;
		for (int i = 0; i < genes.size(); i++) {
			fitnessValue += genes.get(i) * Math.sin(Math.abs(genes.get(i)));
		}
		return fitnessValue;
	}
	@Override
	public int compareTo(Individual o) {
		return (o.getFitness() < fitnessValue ? 1 : (o.getFitness() == fitnessValue) ? 0 : -1);
	}
}



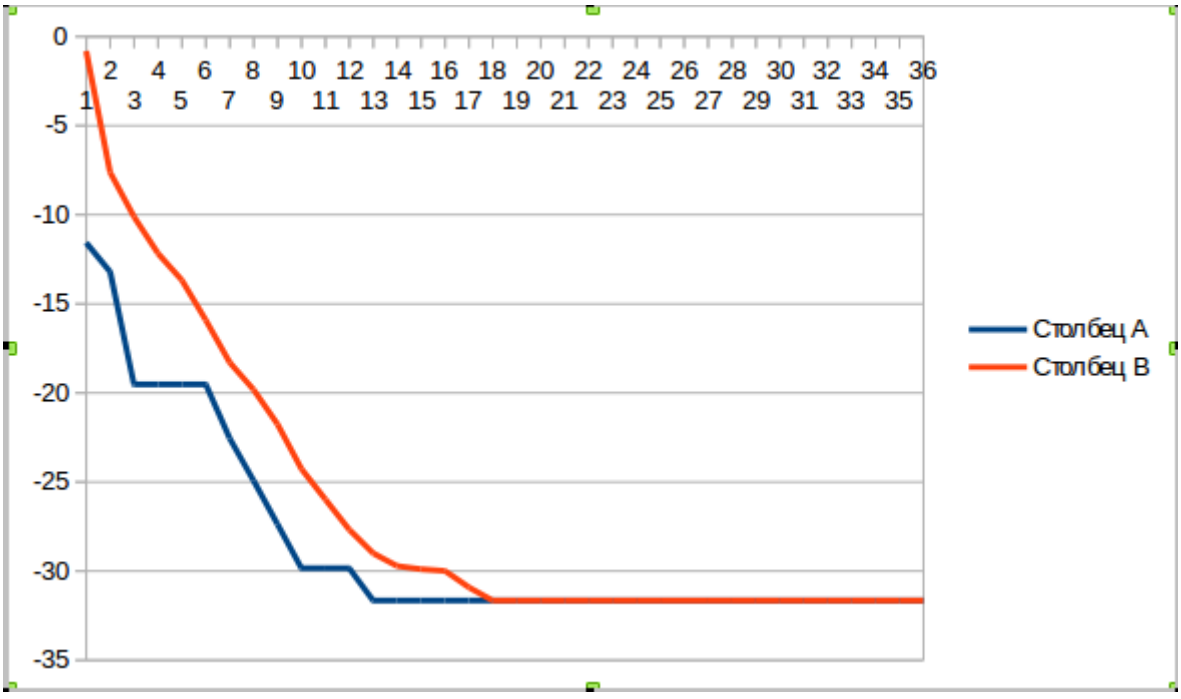

class Population {
	public static final int POPULATION_SIZE = 20;
```

```
	private List<Individual> individuals;
	public Population(List<Individual> individuals) {
		this.individuals = individuals;
	}
	public Population() {
	}
	public static Population newPopulation() {
		Population pop = new Population();
		List<Individual> list = new ArrayList<>();
		for (int i = 0; i < 20; i++) {
			list.add(new Individual());
		}
		pop.setIndividuals(list);
		return pop;
	}
	public List<Individual> getIndividuals() {
		return individuals;
	}
	public void setIndividuals(List<Individual> individuals) {
		this.individuals = individuals;
	}
	public Individual getFittestIndividual() {
		try {
			Collections.sort(individuals);
		}catch(Exception e) {
		}
		return individuals.get(0);
	}
	public double averageFitness() {
		double temp = 0.0;
		for (int i = 0; i < 20; i++) {
			temp += individuals.get(i).getFitness();
		}
		return temp/20;
	}
	public double getMax() {
		return getFittestIndividual().getFitness();
	}
}



import java.util.ArrayList;
import java.util.List;
import java.util.concurrent.ThreadLocalRandom;
/**
 * Created by yauheni on 07.09.16.
 */
public class Main {
	public static void main(String[] args) throws InterruptedException {
		Population pop = Population.newPopulation();
		List<Double> tempList = new ArrayList<>();
		int count=0;
		while(true) {
			count++;
			if(count == 100)
				break;
			System.out.print(pop.getMax() + " ");
			System.out.println(pop.averageFitness());
			Population newPopulation = new Population();
			List<Individual> newIndividuals = new ArrayList<>();
```

```
                List<Individual> individuals = pop.getIndividuals();
                for (int i = 0; i < 10; i++) {
                        int first = ThreadLocalRandom.current().nextInt(0, 20);
                        int second = ThreadLocalRandom.current().nextInt(0, 20);
                        int razrez = ThreadLocalRandom.current().nextInt(0, 20);
                        Individual firstInd = individuals.get(first);
                        Individual secondInd = individuals.get(second);
                        Individual newFirst = new Individual();
                        Individual newSecond = new Individual();
                        for (int j = 0; j < 20; j++) {
                                if(j < razrez) {
                                        newFirst.setGene(j, firstInd.getGene(j));
                                        newSecond.setGene(j, secondInd.getGene(j));
                                } else {
                                        newFirst.setGene(j, secondInd.getGene(j));
                                        newSecond.setGene(j, firstInd.getGene(j));
                                }
                        }
                        newIndividuals.add(newFirst);
                        newIndividuals.add(newSecond);
                }
                newPopulation.setIndividuals(newIndividuals);
                pop = newPopulation;
        }
        System.out.println("============================");
        for (int i = 0; i < tempList.size(); i++) {
                System.out.println(tempList.get(i));
        }
    }
}
```



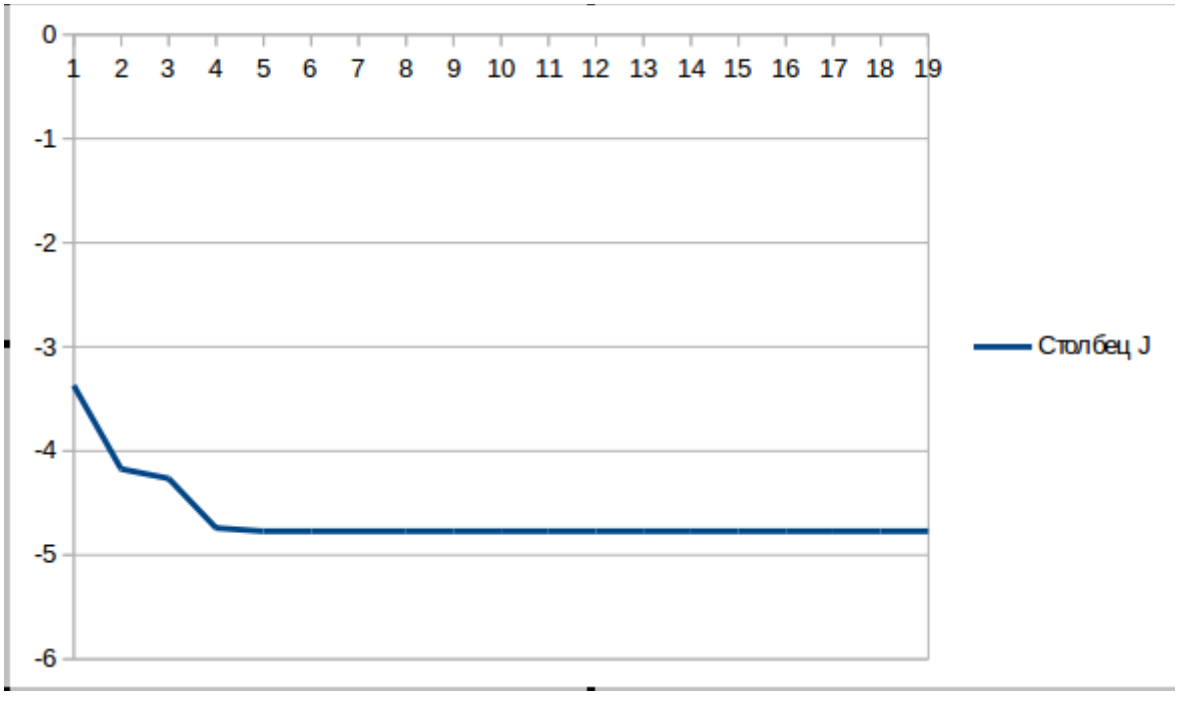
red line is average, blue line is current value.

Data for graphics:

cerrent value	average
-11.572	-0.812
-13.196	-7.623
-19.525	-10.108
-19.525	-12.166
-19.525	-13.666
-19.525	-15.910
-22.552	-18.292
-24.920	-19.822
-27.361	-21.754
-29.841	-24.271
-29.841	-25.972
-29.841	-27.671
-31.654	-28.996
-31.654	-29.715
-31.654	-29.893
-31.654	-29.987
-31.654	-30.913
-31.654	-31.654
-31.654	-31.654
-31.654	-31.654
-31.654	-31.654
-31.654	-31.654
-31.654	-31.654

TASK 2

Average value of function:



Data for diagram:

-3,369247753
-4,173020844
-4,264036829
-4,739874975
-4,771668273
-4,771668273
-4,771668273
-4,771668273
-4,771668273
-4,771668273
-4,771668273
-4,771668273
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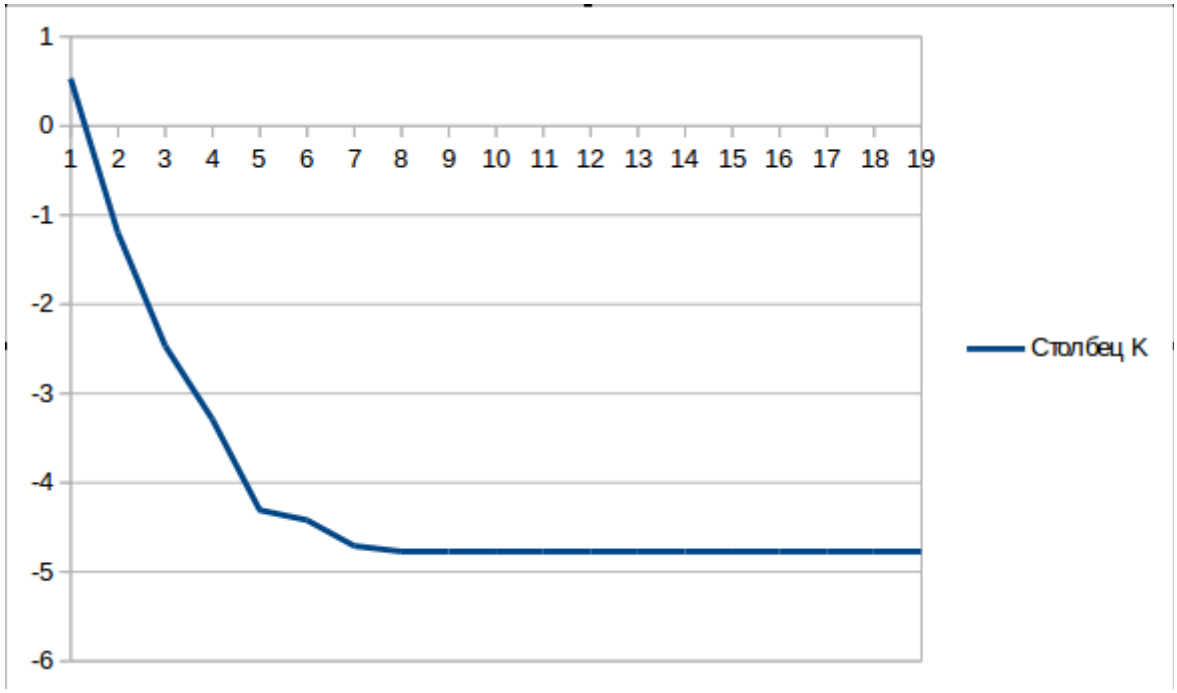
-4,771668273

Min value of function:



Data for diagram:

0,5300566707
-1,199854979
-2,466884085
-3,28967349
-4,307774197
-4,418735643
-4,708187809
-4,771668273
-4,771668273
-4,771668273
-4,771668273
-4,771668273
-4,771668273
-4,771668273
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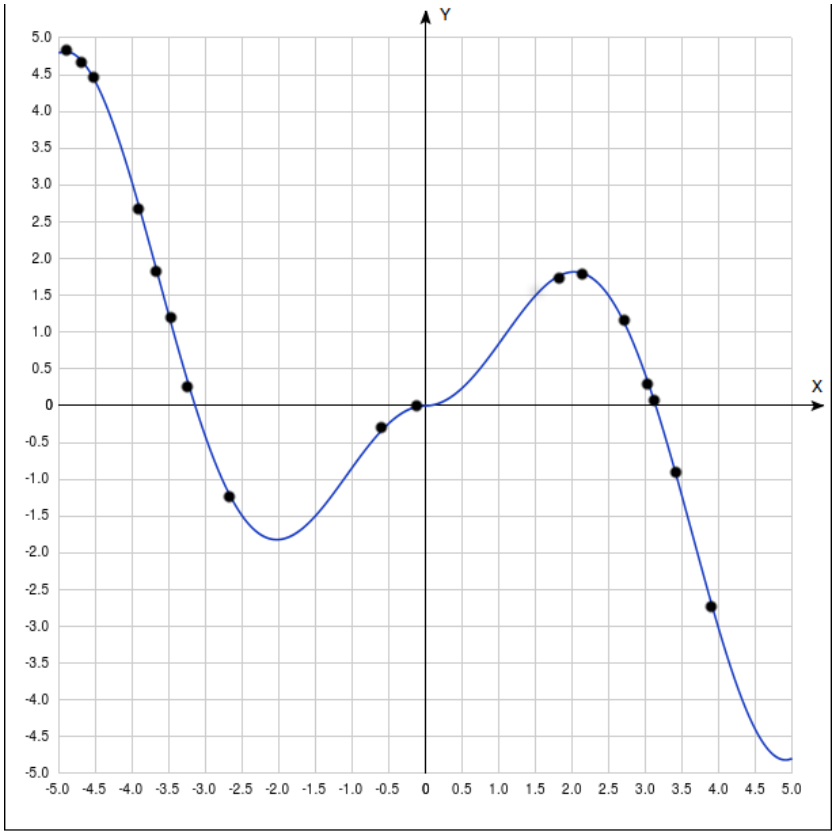
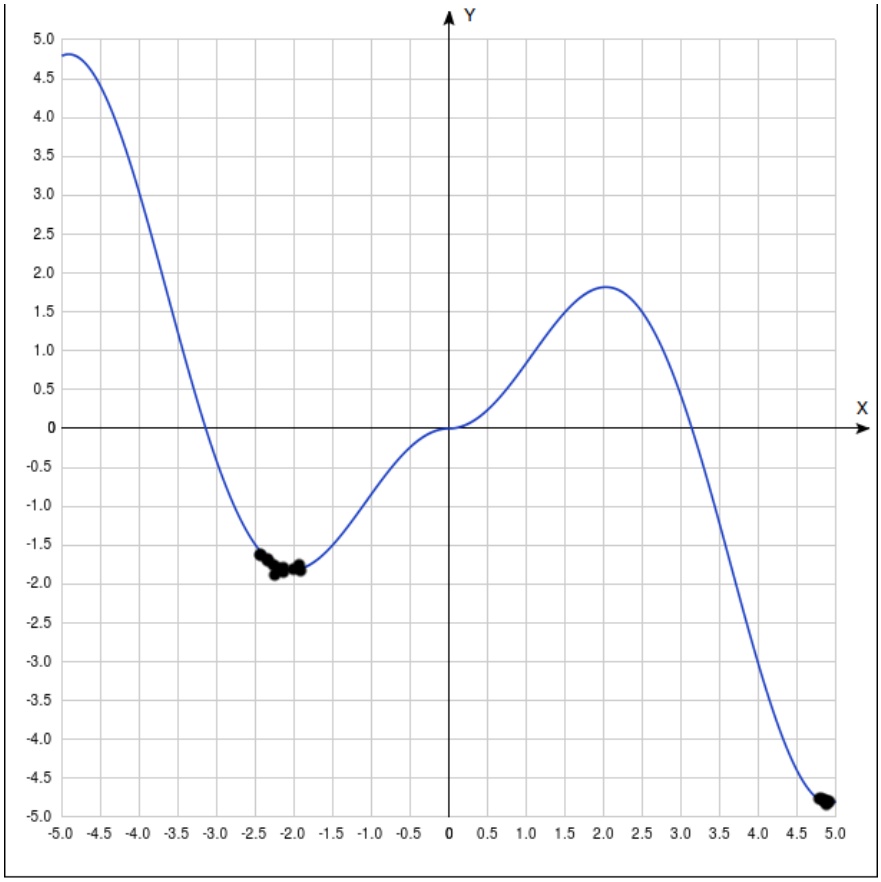
-4,771668273

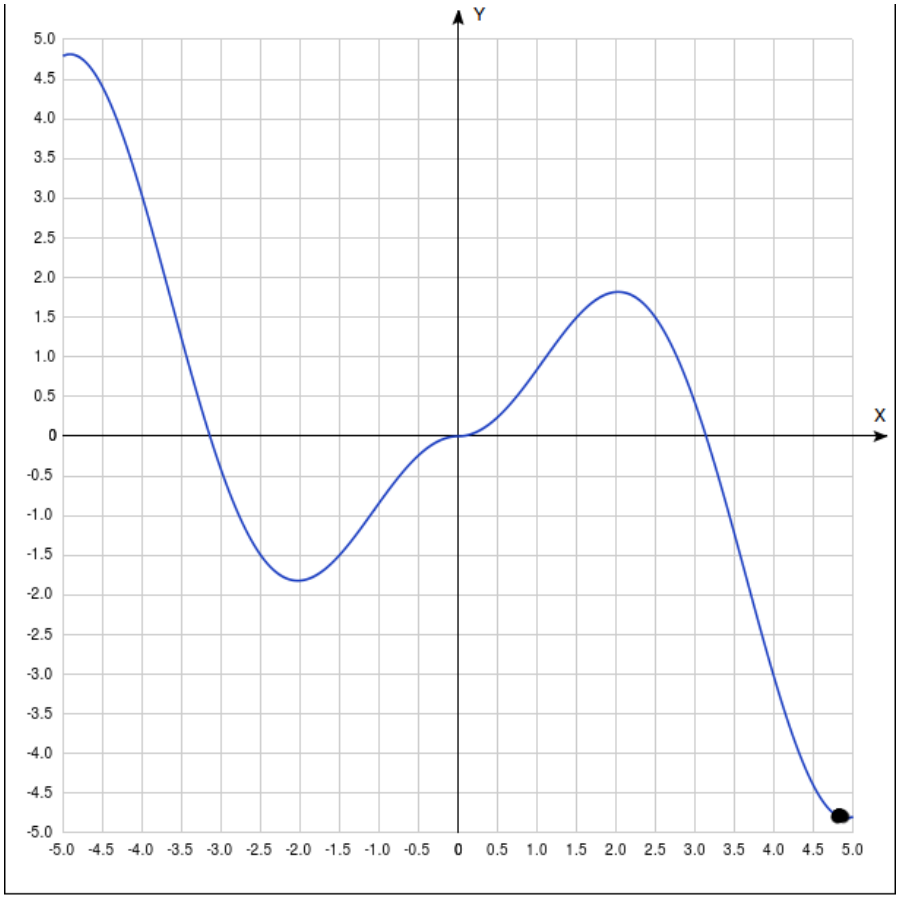
First iterationi:



Fifth iteration:



Tenth iteration:



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 */
public class Main {
	public static void main(String[] args) throws InterruptedException {
		Population pop = Population.newPopulation();
		List<Double> tempList = new ArrayList<>();
		int count=0;
		while(true) {
			count++;
			if(count == 20)
				break;
//		System.out.println(pop.getFittestIndividual().getX());
//		System.out.print(pop.getFittestIndividual().getFitness() + " ");
//		System.out.println(pop.averageFitness());
```

```
                for (int i = 0; i < 20; i++) {
                        pop.getFittestIndividual();
                        System.out.print(pop.getIndividuals().get(i).getX() + " ");
                        System.out.println(pop.getIndividuals().get(i).getFitness());
                }
                System.out.println("=======================");
                Population newPopulation = new Population();
                List<Individual> newIndividuals = new ArrayList<>();
                List<Individual> individuals = pop.getIndividuals();
                for (int i = 0; i < 10; i++) {
                        int first = ThreadLocalRandom.current().nextInt(0, 10);
                        int second = ThreadLocalRandom.current().nextInt(0, 10);
                        int razrez = ThreadLocalRandom.current().nextInt(0, 10);
                        Individual firstInd = individuals.get(first);
                        Individual secondInd = individuals.get(second);
                        Individual newFirst = new Individual();
                        Individual newSecond = new Individual();
                        for (int j = 0; j < 10; j++) {
                                if(j < razrez) {
                                        newFirst.setGene(j, firstInd.getGene(j));
                                        newSecond.setGene(j, secondInd.getGene(j));
                                } else {
                                        newFirst.setGene(j, secondInd.getGene(j));
                                        newSecond.setGene(j, firstInd.getGene(j));
                                }
                        }
                        newIndividuals.add(newFirst);
                        newIndividuals.add(newSecond);
                }
                newPopulation.setIndividuals(newIndividuals);
                pop = newPopulation;
        }
        System.out.println("============================");
    }
}
```