**Research question:**

Our main research question is how the evolutionary algorithm can be adapted to

find the optimal solution of all the three different functions. To answer this question, we will use different parameter combinations per function. The parameters we mainly focus on are (1) population size (2) K-means and (3) Multiple parents.

**Explanation K-Mean:**

The main idea behind K-Means is that you split the population into clusters based on the place of the closest individuals in the search space. The goal is to spread the search in the state space instead of working quickly to one point. This method is very suitable for functions that have a lot of optima (Katsuura).

1. Introduce x random 10-dimentional vectors in the search space. Each vector is one cluster
2. Compute the absolute distance from each “individual” in the population to each cluster
3. Assign each individual to the closest cluster
4. Compute the new average cluster point based on the individuals wich are assigned to the cluster.
5. Repeat step 2 t/m 4 untill there is no new average cluster point.
6. Create diversity within the cluster (recombination and mutation).

**Explanation Multiple parents:**

The main idea is that the recombination is performed by three parents (instead of 2) to create 1 offspring (child). The genes from the 3 parents are divided ass follow:

**Explanation population size**

For the Bent Cigar and Schaffers function we used the ‘standard’ population size of 100 individuals. For the Katsuura we have chosen for a population size of 1000. We chose this number because we want to apply the "K-means" method to the Katsuura. Using a population that is too small for "k-means" would have no effect because there is too little spread in the search space.

Voorbeelden research questions

“Our main research question is how the differential evolution algorithm can be adapted to find the optimal solution of all three functions. To answer this question, we find the optimal parameter settings for the three different functions. Additionally, we try to identify the most important parameters that are responsible for these performance levels.”

“We investigate the effect of different ways to increase diversity in the population. The different possibilities that we investigate are (1) increase the chances of the variation operators before the run and (3) change parameters of the variation operators during the run. We investigate whether there is a relation between the diversity level during the run and the final performance level.”

“Function optimization is usually implemented with a one dimensional fitness function. Due to the importance of diversity, we add another dimension in the fitness function describing the novelty of the solution. We hypothesize that the 2 dimensional fitness function increases performance over the one dimensional fitness function due to the increase of diversity in the population.”

“Island models are known to increase diversity because each island can focus on a different (local) optima. We believe that this is dependent on the specific sharing mechanisms between the islands. With clear visualizations we examine to what extent islands really focus on only one (local) optima on the Katsuura function.”