Exercise 5.1: Fuzzy Clustering (10 Points)

Use the fuzzy clustering technique \texttt{fanny} that is provided in the R package \texttt{cluster}, see e.g.: http://mirrors.softliste.de/cran/web/packages/cluster/

Apply the clustering algorithm to the data set \texttt{fuzzy-clusters.txt} and try 3 values for the number of clusters $K \in \{2, 3, 4\}$. Comment informally, which value of $K$ seems to be the best one.

Exercise 5.2: (1+1)EA (10 Points)

a) Implement a (1+1)-EA in R that can operate on bitstrings and on real-valued vectors. The initialization shall be uniformly at random in the search space. Terminate on bitstrings when the known optimum is found, terminate on real-valued vectors when the known optimum is in a distance of $\epsilon = 0.01$.

b) Implement the standard-bit-mutation as mutation operator for bitstrings.

c) Implement a gaussian mutation using a stepsize as a parameter as mutation operator for real-valued vectors.

d) Minimize $f(x) = \sum_{i=1}^{n} x_i$, with $x_i \in \{0, 1\}$, for $1 \leq i \leq n$.

e) Minimize $f(x) = \sum_{i=1}^{n} x_i^2$, with $x \in \mathbb{R}^n$, $x_i \in [-10, 10]$.

f) Document the distance to the optimum for $n = 20$ and repeat your EA 10 times. Give the median, average value and standard deviation of the number of generations until the termination.