Assignment: Maximization of a (complicate) function by a genetic algorithm

Let D be the set of non-negative integers smaller or equal to $2^{32} - 1 = 4294967295$ (that is, the elements of D are `unsigned long int` constants) and let E denote D^4 (that is, E is the set of vectors of length 4 with entries in D). Let $f\colon E \longrightarrow \mathbb{R}$ denote the function defined as follows. First define a four parameter function $\varphi\colon E \longrightarrow \mathbb{R}$ by:

$$\varphi(x, y, z, t, a, b, c, d) := 2^{43} - (x - a)^2 - (y - b)^2 - (z - c)^2 - (t - d)^2.$$

Then,

$$\begin{aligned} f(x, y, z, t) :=& (-1)^{\mathsf{s}} \cdot \sin(x + y + z + t) \cdot \\ & \varphi(x, y, z, t, 1237566.4, 54783217.5, 1237896431.1, 325123467.37) \cdot \\ & \varphi(x, y, z, t, 5674235.4, 4067231567.2, 13245678.3, 3748967543.2) \cdot \\ & \varphi(x, y, z, t, 3867435523.2, 7134893.75, 3565897564.1, 15675987.34) \cdot \\ & \varphi(x, y, z, t, 4000223567.09, 3734098765.4, 3367981234.4, 4067231567.25), \end{aligned}$$

where

$$\mathsf{s} := \left[\frac{x + t}{2^{31} + y + z} + 0.86525597943226508722 \right]$$

and, as usual, $[\cdot]$ denotes the integer part function.

To calculate the maximum of f write a program that implements an appropriate genetic algorithm. The choices made in the algorithm (type of crossover, type of mutation, probability of mutation, size of the population, number of generations in a run, ...) should be commented and justified. The result and its quality should be also addressed.

Remark. The functions involved in the definition of f are rather complicate. In shake of precision and speed it is recommended to program these functions and numbers taking into account these issues and using all possible shortcuts.