HW1

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Problem1

(a) I used Golden Section Method to build the optimizer function optimizer1D(func, x1, s). I selected $\epsilon_x = 1\mathrm{e}-4$ and $\epsilon_F = 1\mathrm{e}-6$. We can calculate the machine precision $\epsilon_m = 2.22\mathrm{e}-16$ through the function MEp(). The input of the optimizer function are func (the function which we want to find its optimum), x1 (the starting point), s (the step). The output is the optimum and the number of function used.

(a) I chosen $\mathrm{f}_1(\mathrm{x}) = x^2 - 2x + 1$ and $\mathrm{f}_2(\mathrm{x}) = e^{x+2} - x$ as my objective functions. I chosen 0.3 as the step. The starting point is randomly chosen from uniform distribution between -1 and 1. The true optimum of $\mathrm{f}_1(\mathrm{x})$ and $\mathrm{f}_2(\mathrm{x})$ are 1 and -2 respectively.

function	Number	Time	Relative distant
$\mathrm{f}_1(\mathrm{x}) = x^2 - 2x + 1$	15 + _2.042	0.01699 + _0.01224	0.00049 + _0.00122
$\mathrm{f}_2(\mathrm{x}) = e^{x+2} - x$	17 + _0.001	0.01815 + _0.00208	0.00037 + _0.00051

Problem2

(b) I used multidimensional coordinate descent method to build the optimizer function optimizer2D(func, x1, y1, s) basing on the function optimizer1D(func, x1, s). The output is the optimum and the number of function used.

(c) I chosen $\mathrm{f}_1(\mathrm{x}) = x^2 + y^2$ and $\mathrm{f}_2(\mathrm{x}) = (x-1)^2 + e^{y+2} - y$ as my objective functions. I chosen 0.3 as the step. The starting points are randomly chosen from uniform distribution between -1 and 1. The true optimum of $\mathrm{f}_1(\mathrm{x})$ and $\mathrm{f}_2(\mathrm{x})$ are (0,0) and (1,-2) respectively.

function	Number	Time	Relative distant
$\mathrm{f}_1(\mathrm{x}) = x^2 + y^2$	68 + _0	0.07171 + _0.00587	0.00031 + _0
$\mathrm{f}_2(\mathrm{x}) = (x-1)^2 + e^{y+2} - y$	73 + _0.40822	0.07765 + _0.01205	0.00031 + _0