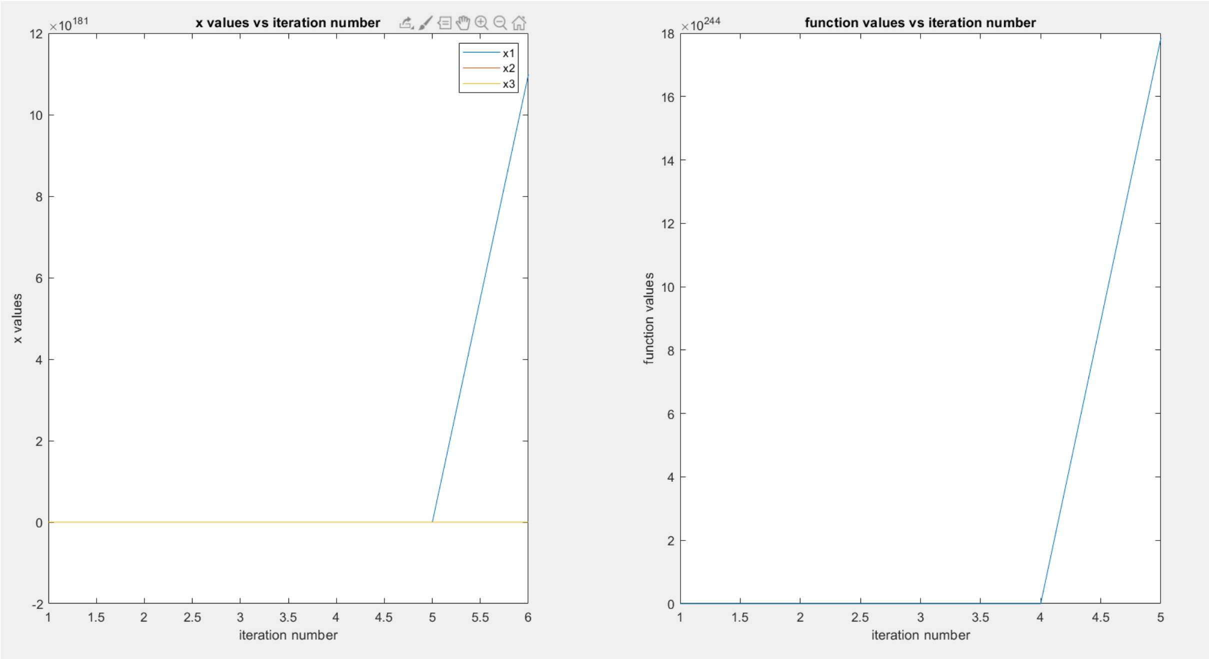
Berkay Gümüş
2015401183

EE457 HW 3 REPORT

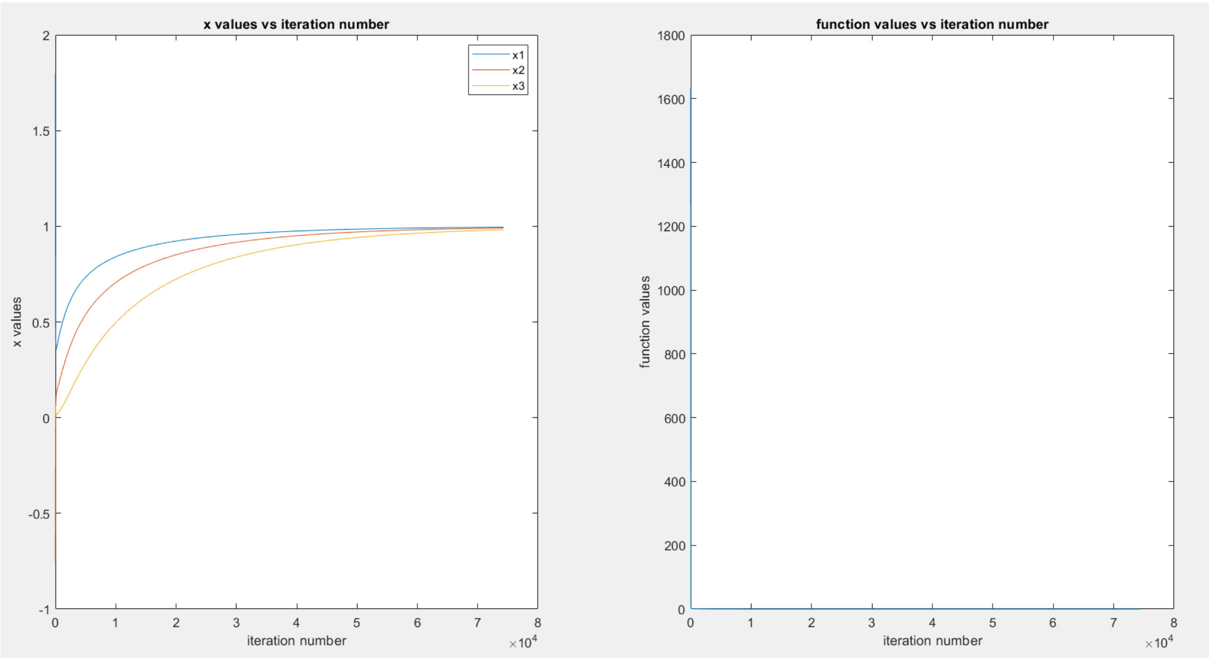
P1) The gradient algorithm with a fixed step size

When the step size is 0.001, the x values do not converge and the algorithm doesn’t meet the termination criteria.



Function values diverge and go to the infinity.

When the step size is 0.0001, the x values converge to [0.9955 0.9909 0.9819] and f values converge to 1.0362e-04. The f values at the beginning are much higher than next f values, the plot of f values can not be seen. If the plot is zoomed in, it can be seen the convergence.

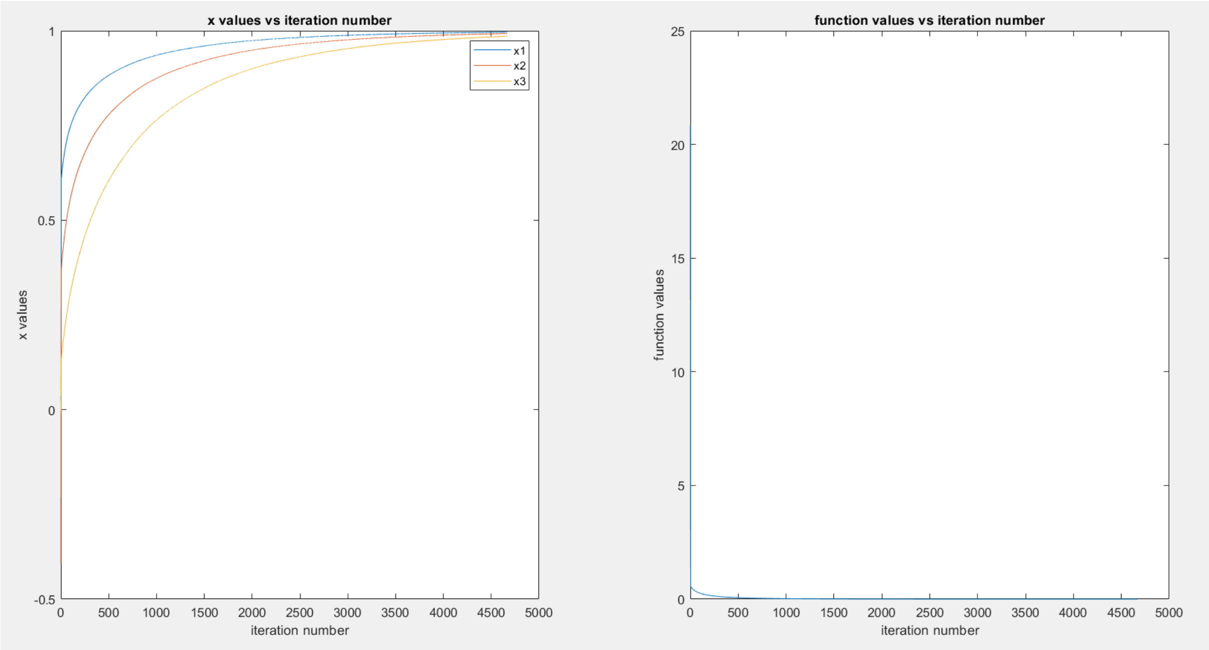


Berkay Gümüş
2015401183

P2) The steepest descent algorithm using the golden section method for the exact line search

The initial interval for optimal alfa is [0,1] and the golden section algorithm runs until the interval length becomes less than 0.0001. It returns the midpoint of the interval as the optimal step size.

x values converge to [0.9964   0.9928   0.9856] and f values converge to 6.5033e-05.



P3) the gradient descent algorithm using the first Armijo condition for the line search

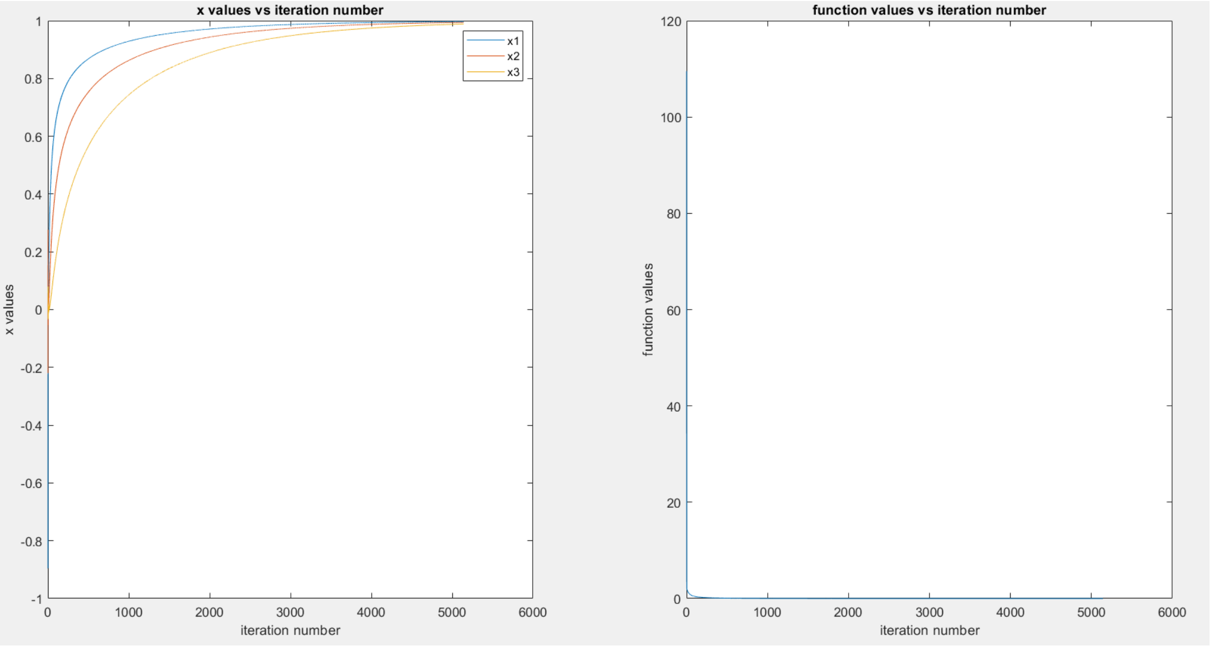
The initial alfa = 1

Epsilon = 0.2

Tau = 0.8 for the line search.

x values converge to [0.9971   0.9943   0.9886] and f values converge to 4.1118e-05.

Berkay Gümüş
2015401183



P4) the gradient descent algorithm using the Armijo-Goldstein conditions for the line search

The initial alfa = 1

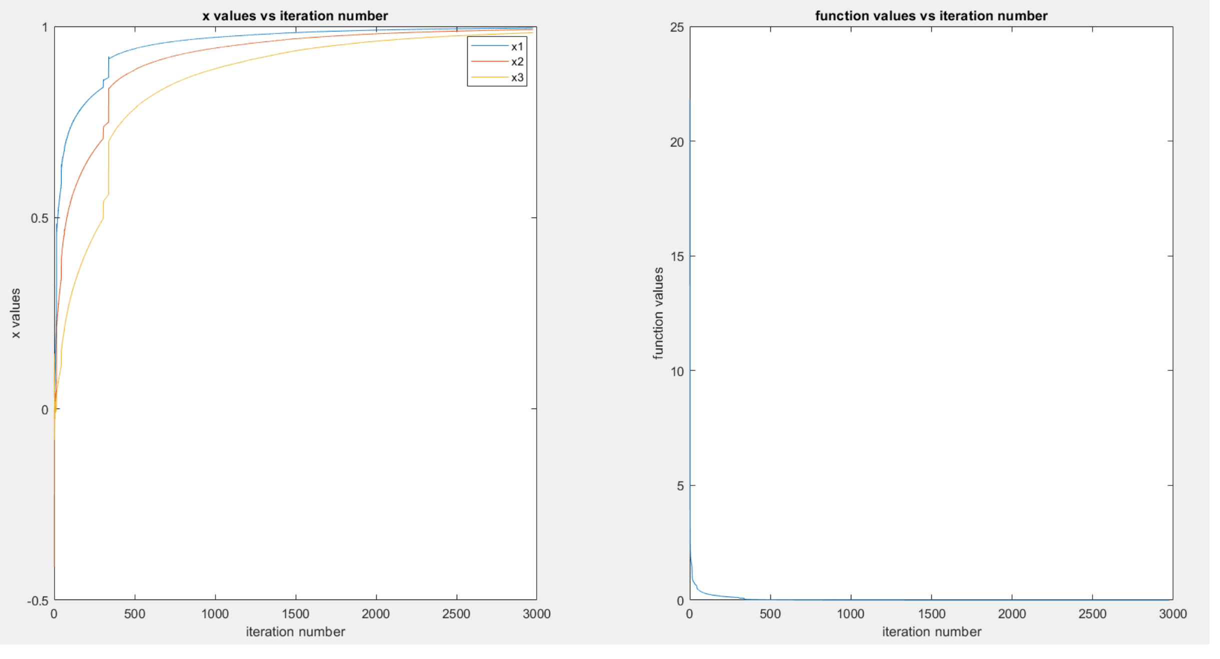
Epsilon = 0.2

Eta = 0.8

Tau1 = 0.5

Tau2 = 1.5 for the line search.

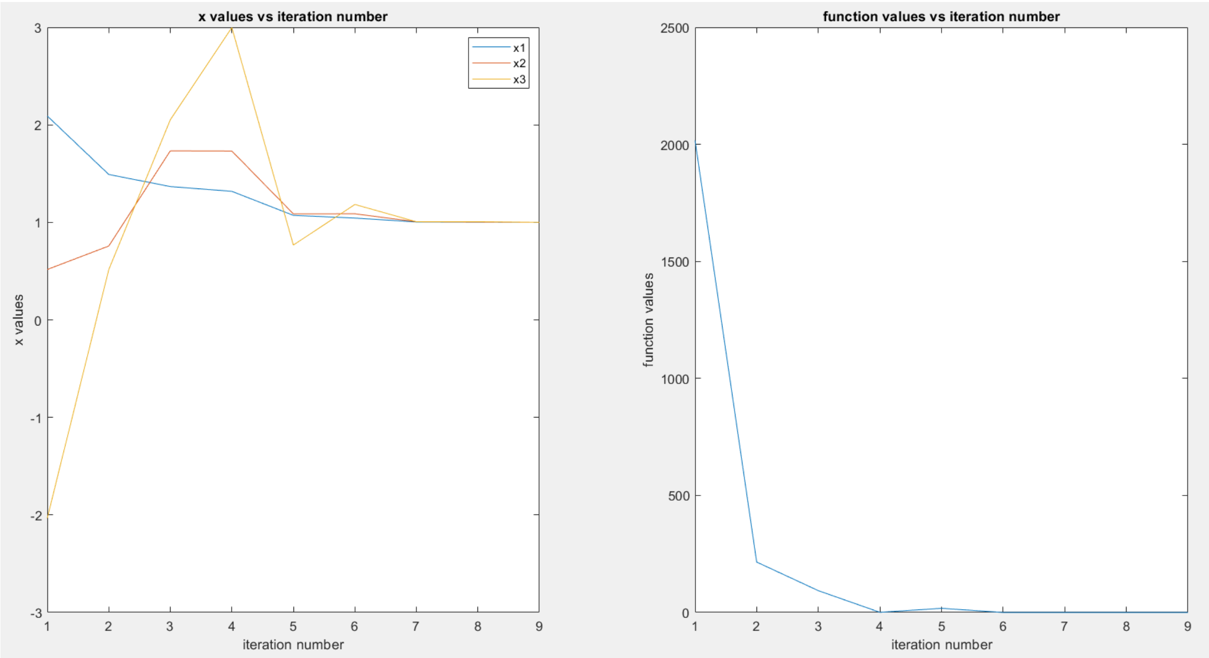
x values converge to [0.9958   0.9917   0.9834] and f values converge to 8.6917e-05.



Berkay Gümüş
2015401183

P5) Newton's method

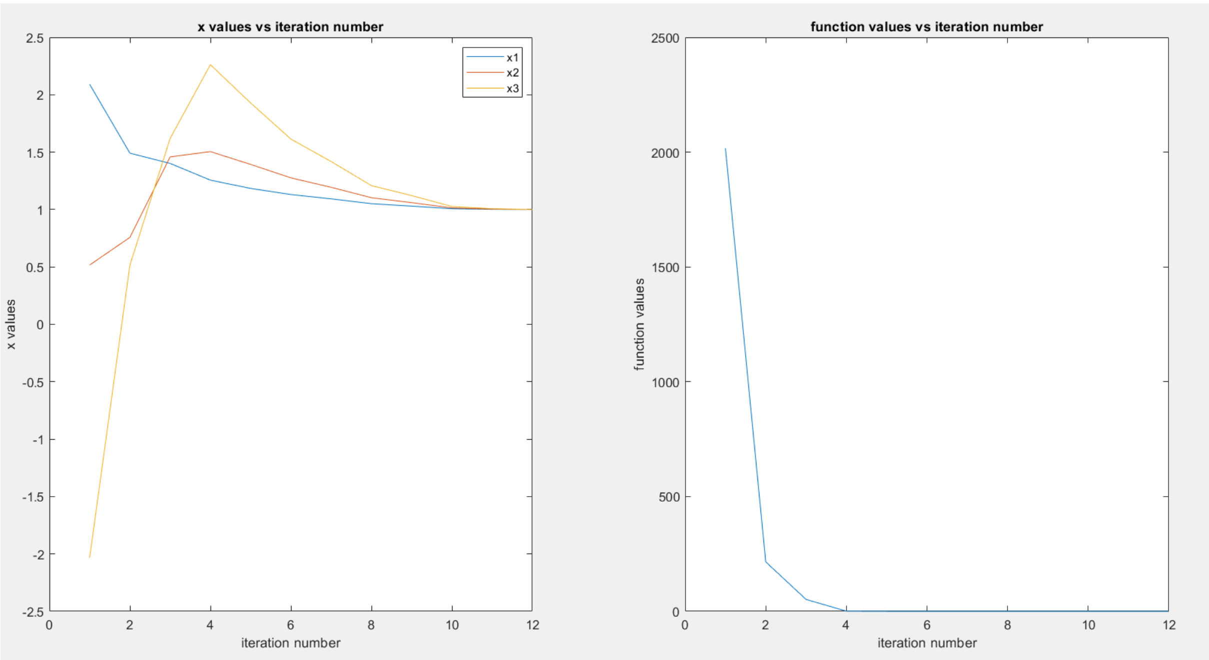
x values converge to [1.0000   1.0000   1.0000] and f values converge to 0.



P6) modified Newton method using the golden section method for the exact line search

The initial interval for optimal alfa is [0,1] and the golden section algorithm runs until the interval length becomes less than 0.0001. It returns the midpoint of the interval as the optimal step size.

x values converge to [1.0000   1.0001   1.0001] and f values converge to 1.4603e-08.



Berkay Gümüş
2015401183

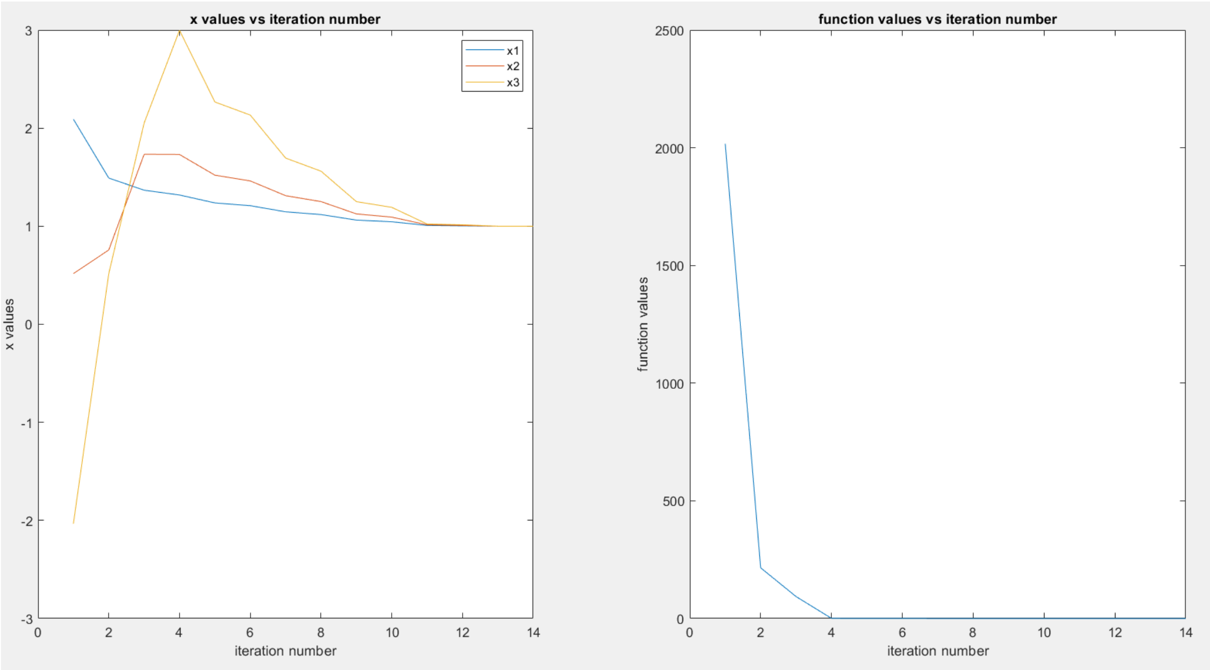
P7) modified Newton method using the first Armijo condition for the line search

The initial alfa = 1

Epsilon = 0.2

Tau = 0.8 for the line search.

x values converge to [1.0000   1.0000   1.0000] and f values converge to 0.



P8) modified Newton method using the Armijo-Goldstein conditions for the line search

The initial alfa = 1

Epsilon = 0.2

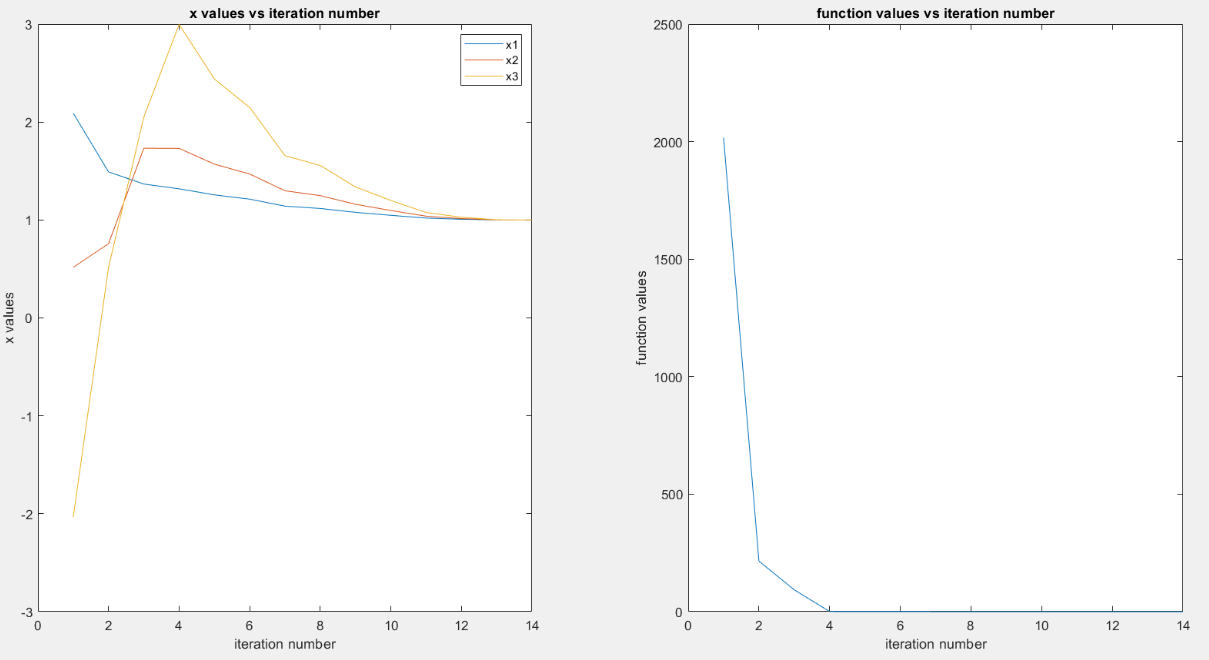
Eta = 0.8

Tau1 = 0.5

Tau2 = 1.5 for the line search.

x values converge to [1.0000   1.0000   1.0001] and f values converge to 1.8863e-09.

Berkay Gümüş
2015401183



P9)

		#iterations for the vector update	(mean) #iterations for the line search	Final function value (10^{-3})
1	gradient algorithm with a fixed step size= 0.0001	74270	-	0.1036
2	steepest descent algorithm using the golden section	4667	20.0	0.0650
3	gradient descent algorithm using the first Armijo condition	5141	28.8	0.0411
4	gradient descent algorithm using the Armijo-Goldstein conditions	2975	10.1	0.0869
5	Newton's method	9	-	0.0000
6	modified Newton method using the golden section	12	20	$1.4603*10^{-5}$
7	modified Newton method using the first Armijo condition	14	0.6	0.0000
8	modified Newton method using the Armijo-Goldstein conditions	14	1.2	$1.8863*10^{-6}$

(It is expected that the line search algortihm converges fast using only the first armijo condition than the algorithm using both two conditions. The reason of that the number of the iterations for the line search for q3 is higher than for q4 is that tau is 0.8 for q3 whereas tau1 is 0.5 for q4. When tau is 0.8, it converges slower than tau is 0.5 for the first armijo condition.)