Report: Lab 05

Submitted by: Aakash Banik (16i190010)

Question 1:

FILE : ex1b.py

Subpart a:

we assumed that the algorithm converges if the L2 Norm of the grad function is close to zero.

Subpart d and e:

$[0.9996531031361613, 0.99993097077413662]$ is the stationary point calculated by the algorithm. Refer figure 1.

No. of iterations required is 3234. Refer figure 1.


```
Optimal solution is:  [0.9999952378497455, 0.9999904708253279]
Minimum Value of the function is:  2.26804729516e-11
No. of iterations required is:  3223
aakash.b@saki:~/ie684/lab5$
```

Figure 1: An output to ques 1, part 4 and 5

Subpart f : (Refer figure 2)

The iterations start from $(-1, -1)$ and then slowly converges towards $(1, 1)$. The x[0] coordinate increases throughout each iteration, but the x[1] coordinate does not show any such behaviour; It decreases till some point and increases thereafter converging to 1.
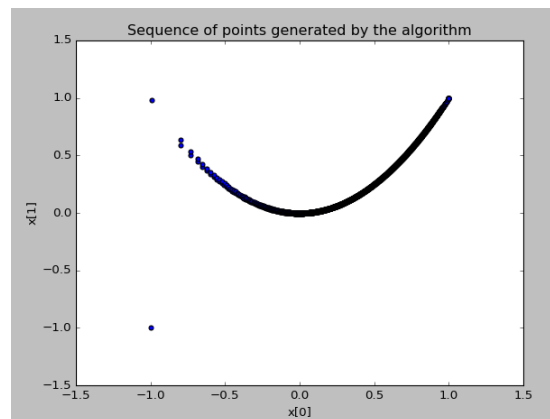

Figure 2: points calculated in i^{th} iteration in Newton's method
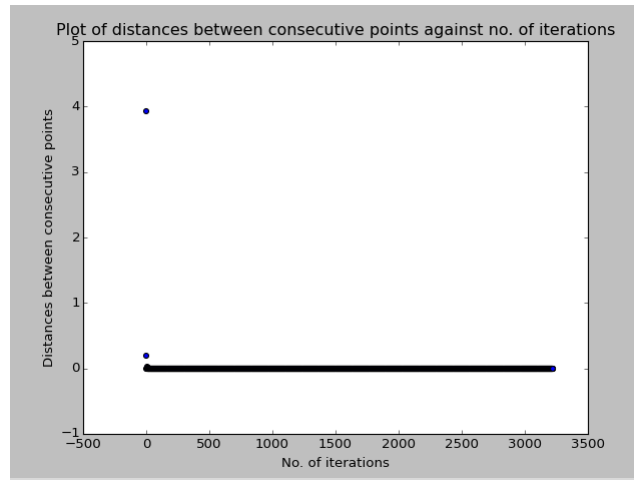
Figure 3: Distance between consecutive values of x as a function of number of iterations

Subpart g : (Refer figure 3)
We can see from the plot that the distances between the consecutive values of x against the iterations is decreasing and ultimately converges to zero.
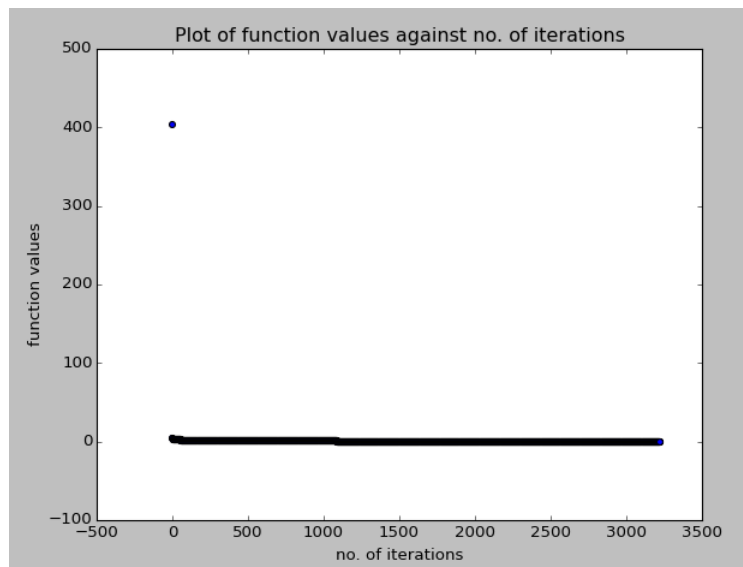

Figure 4: Function value against number of iterations

Subpart h : (Refer figure 4)
From the plot we can see that the function values keeps on decreasing and since the points converges to a stationary point, we can conclude the function values converges to a minima.

Question 2:

ex2b.py The function is unbounded below. So it does not have a local minima. Hence no associated outputs are attached.

Subpart a:
The initial choice of B is an identity matrix of order 200.

Question 3:
Subpart a:
FILE: ex3a.py
Refer figures 5,6,7

```
The sequence converges to : 1.00000000076
Sequence is Superlinear
Sequence is Q-Linear
Sequence is Q-quadratically with M= 147120754.455
```
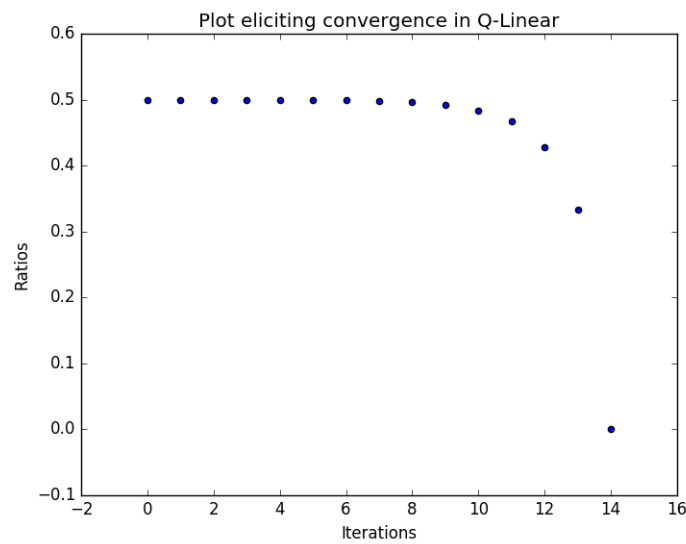
Figure 5: Output to question 3 part 1 function 1

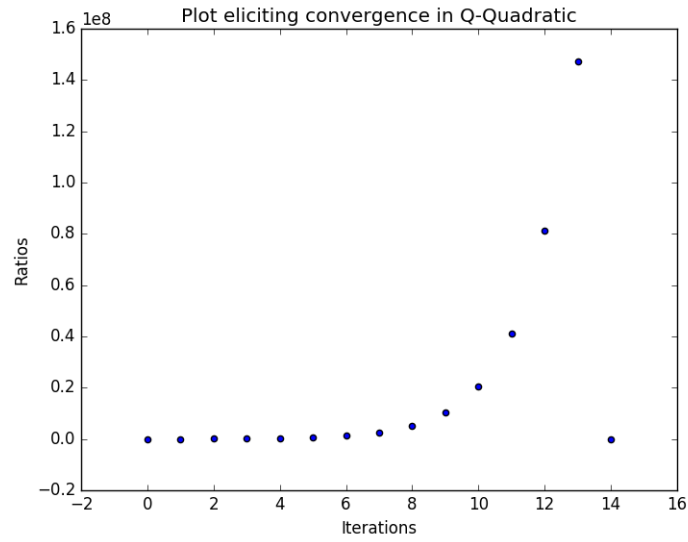Figure 6: Linear convergence rate against iterations for function 1

Figure 7: Quadratic convergence rate against iterations for function 1

Subpart b:
FILE: ex3b.py
Refer figures 8,9,10

```
The sequence converges to : 1.00000000093
Sequence is Superlinear
Sequence is Q-Linear
Sequence is Q-quadratically with M= 119304647.111
```
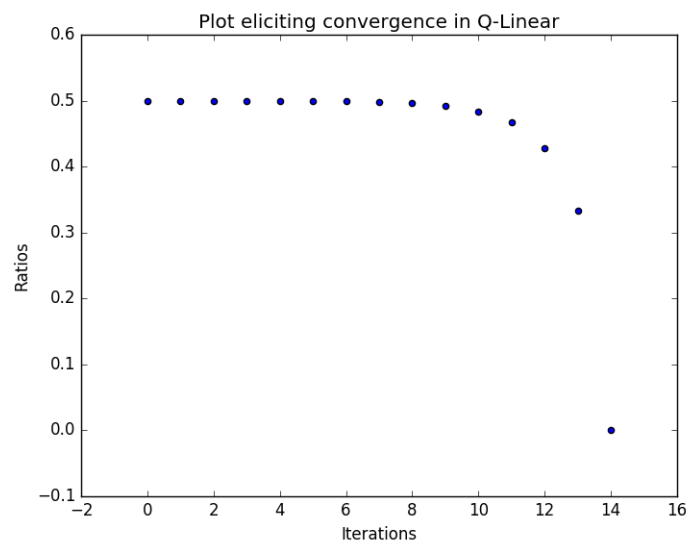
Figure 8: Output to question 3 part 1 function 2

Figure 9: Linear convergence rate against iterations for function 2

Subpart c:

FILE: ex3c.py
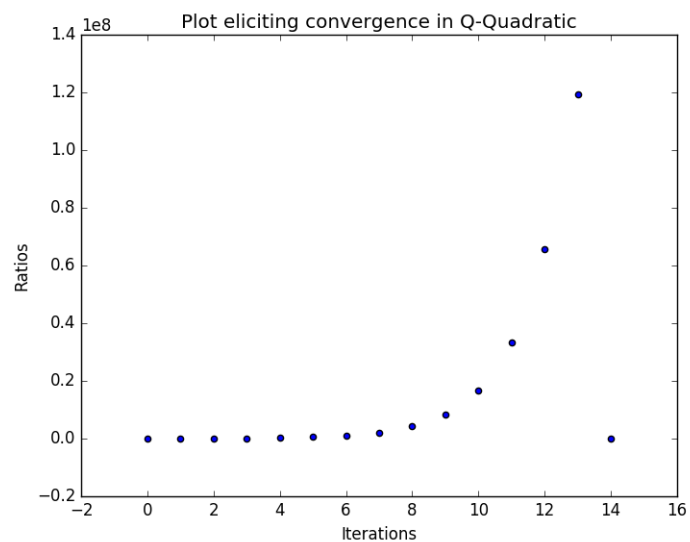Refer figures 11,12,13

Figure 10: Quadratic convergence rate against iterations for function 2

```
The sequence converges to : 1.0
Sequence is Superlinear
Sequence is Q-Linear
Sequence is Q-quadratically with M= 14522800.7484
```

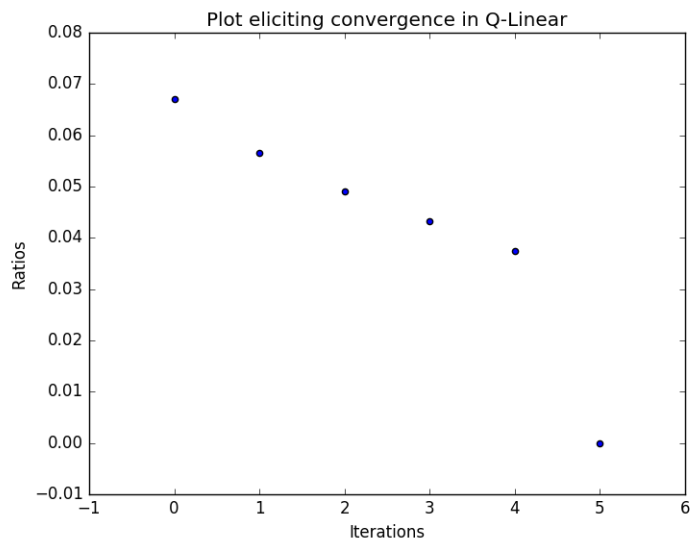Figure 11: Output to question 3 part 1 function 3

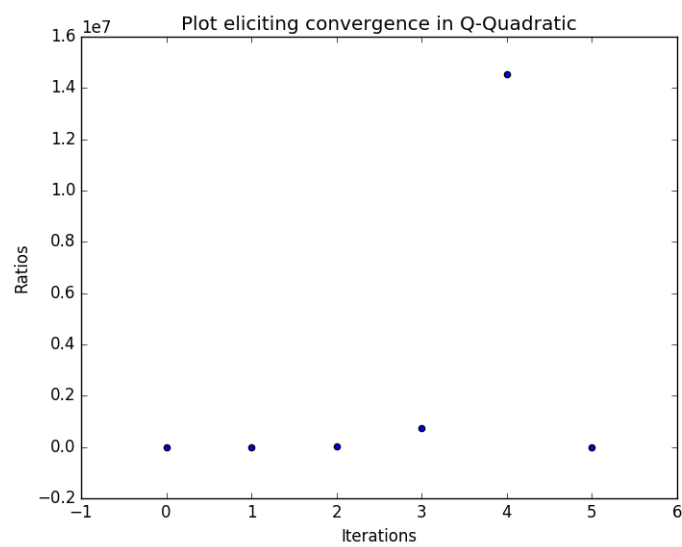Figure 12: Linear convergence rate against iterations for function 3

Figure 13: Quadratic convergence rate against iterations for function 3