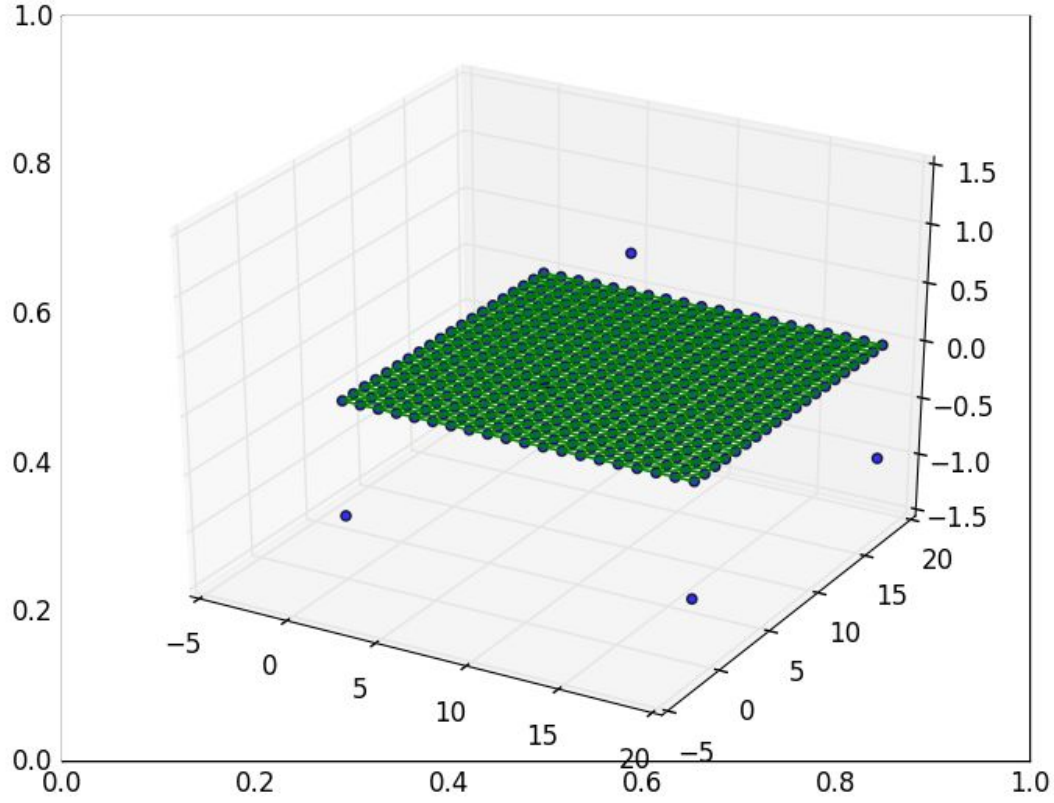
CS 395T: Numerical Optimization
Homework 2
Submitted by: Angela Lin
Due Date: October 3, 2017

Problem 1 and 2:

Starting Configuration:

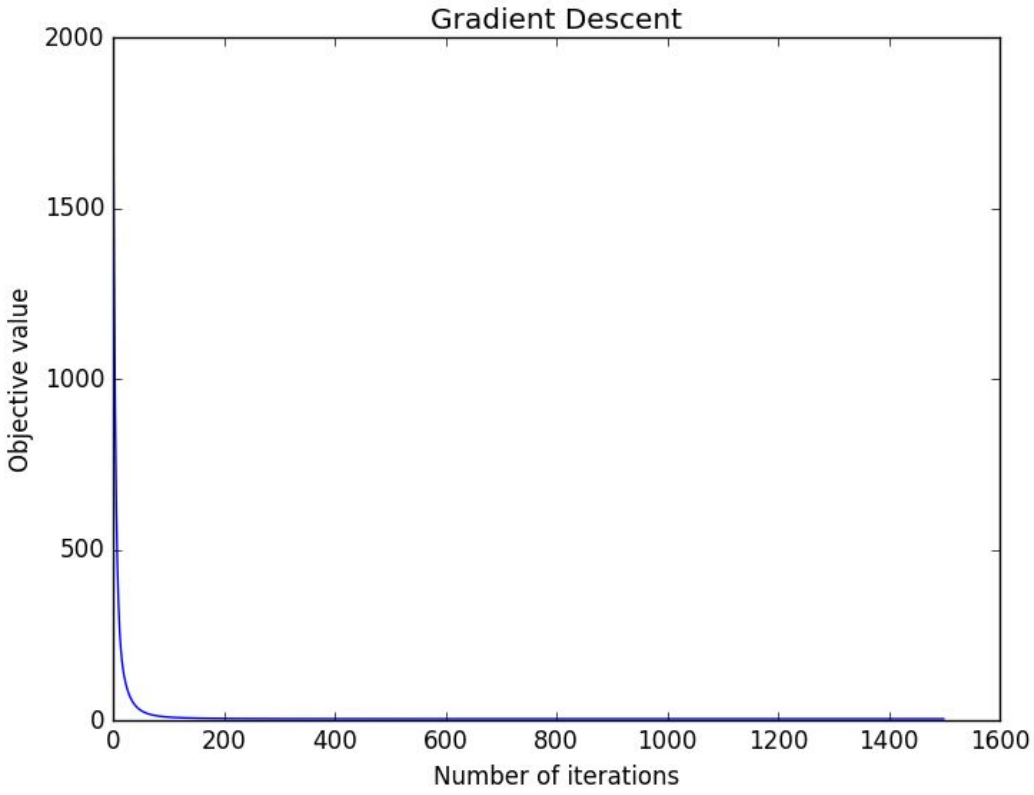
Handle targets at -1 below the corners and 1 above the center in the z-axis. I used a lambda of 90 and a 20 x 20 grid. My computer runs out of memory when I try to run my alternating minimization program on a 100 x 100 grid. My implementation of alternating minimization achieves a better minimum compared to gradient descent.

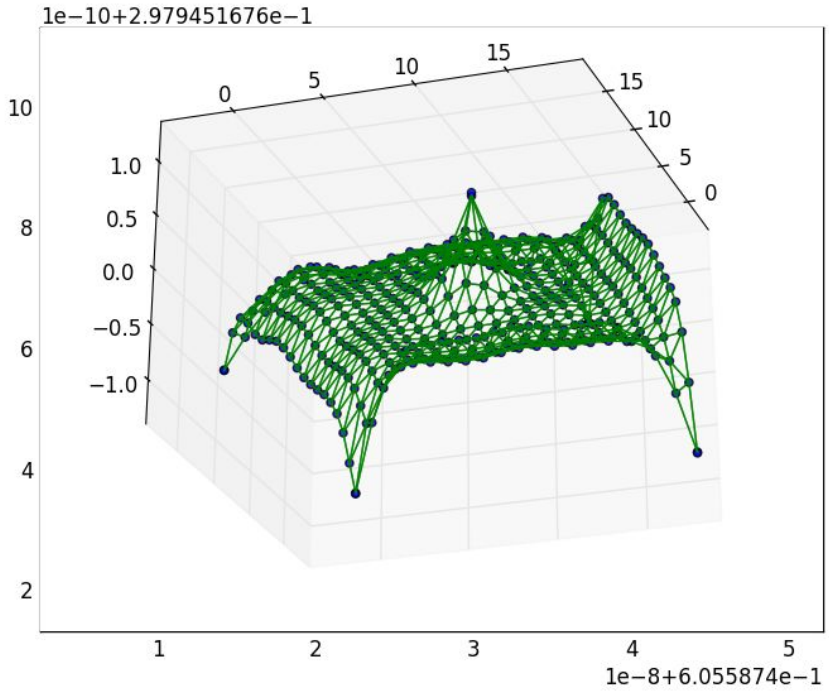


Gradient Descent:

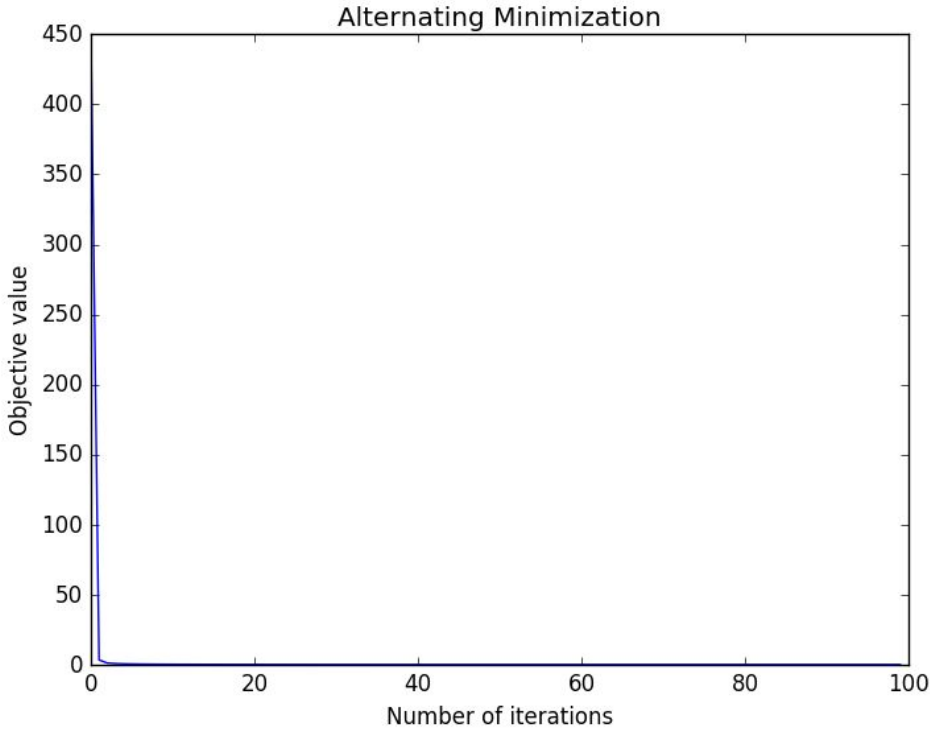
Step size: .01

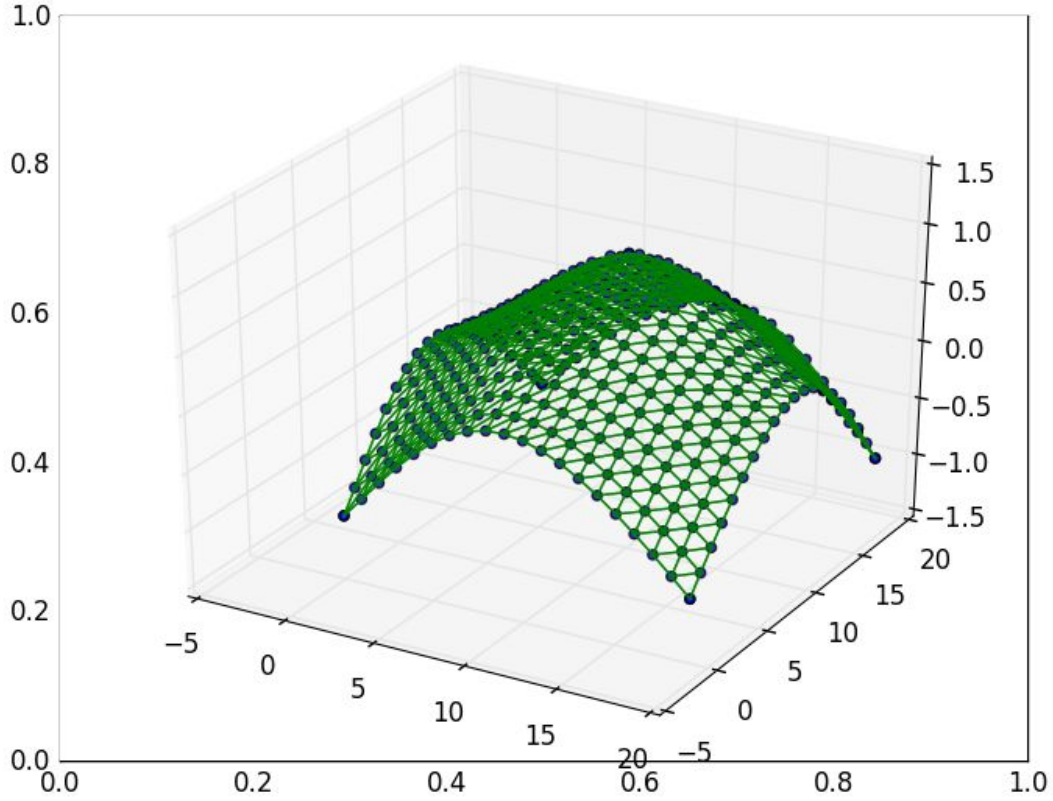
Iteration 1500 with objective value of 5.18030254757.

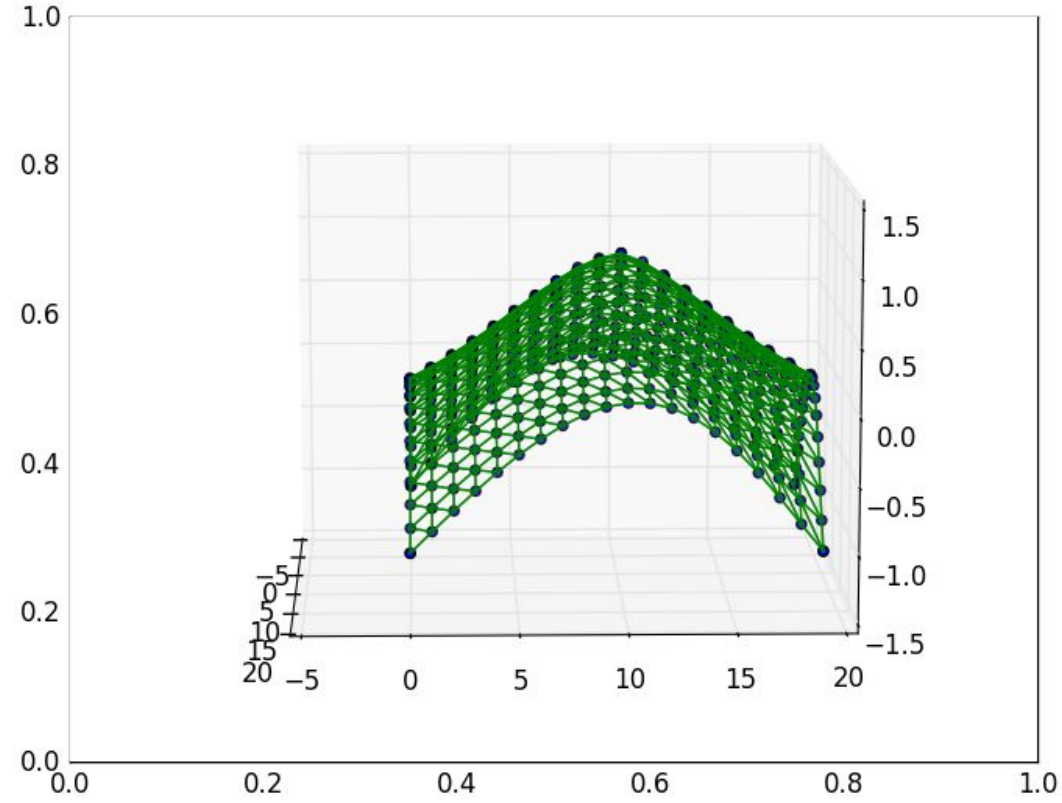

Gradient Descent
Objective value
Number of iterations
2000
1500
1000
500
0
0
200
400
600
800
1000
1200
1400
1600

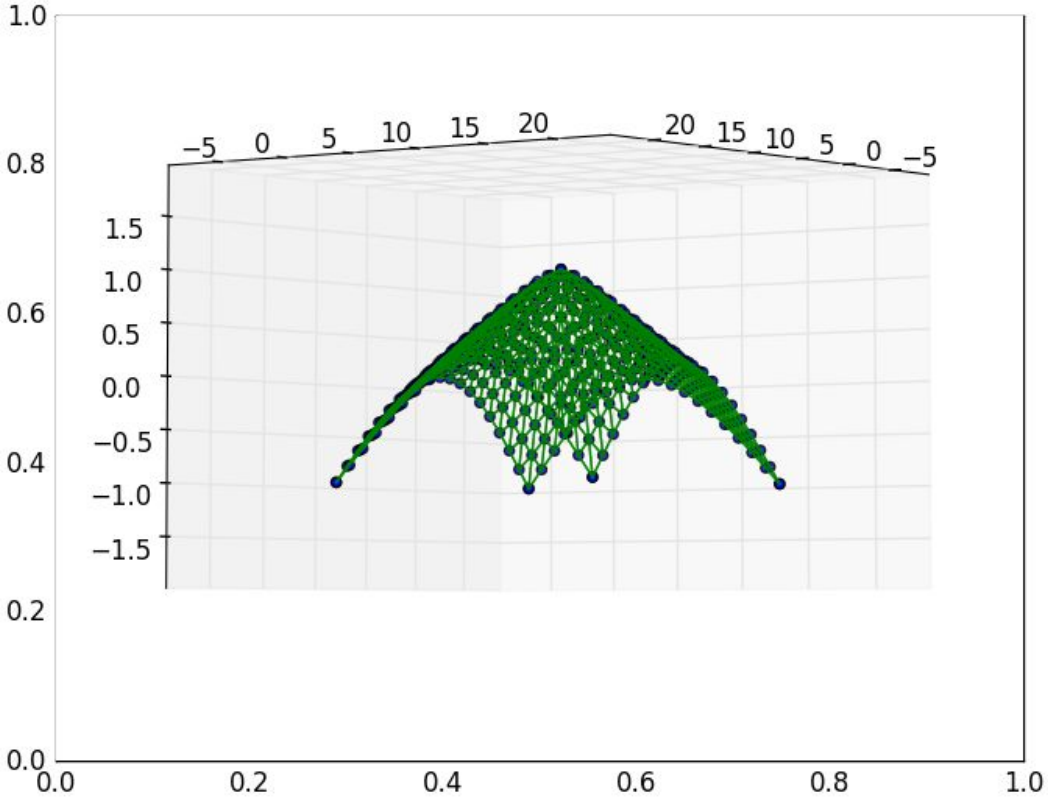

1e−10+2.979451676e−1
1e−8+6.055874e−1
10
8
6
4
2
1
2
3
4
5
0
5
10
15
15
10
5
0
1.0
0.5
0.0
−0.5
−1.0

Alternating Minimization
Iteration 100 with objective value of 0.414654789508



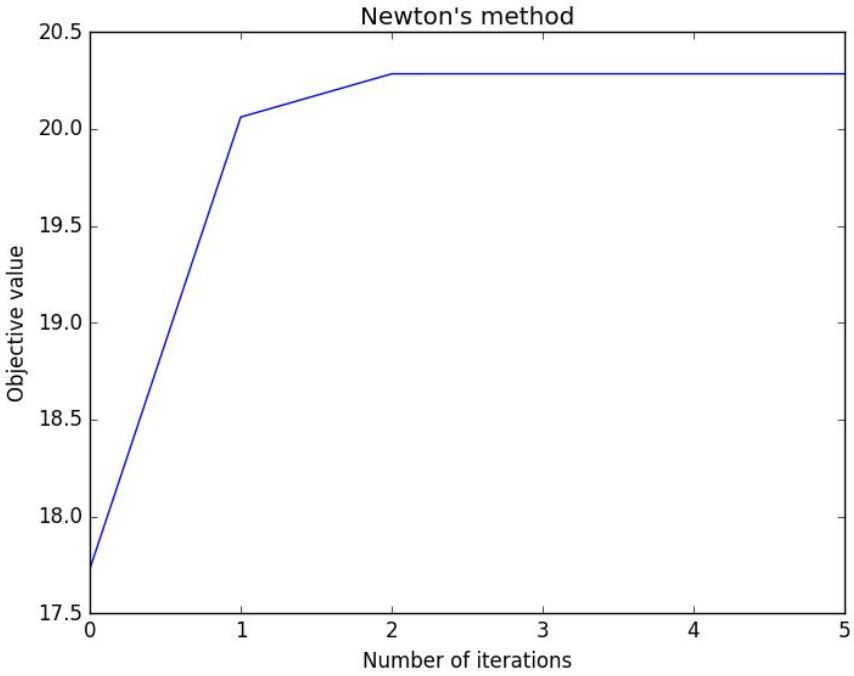


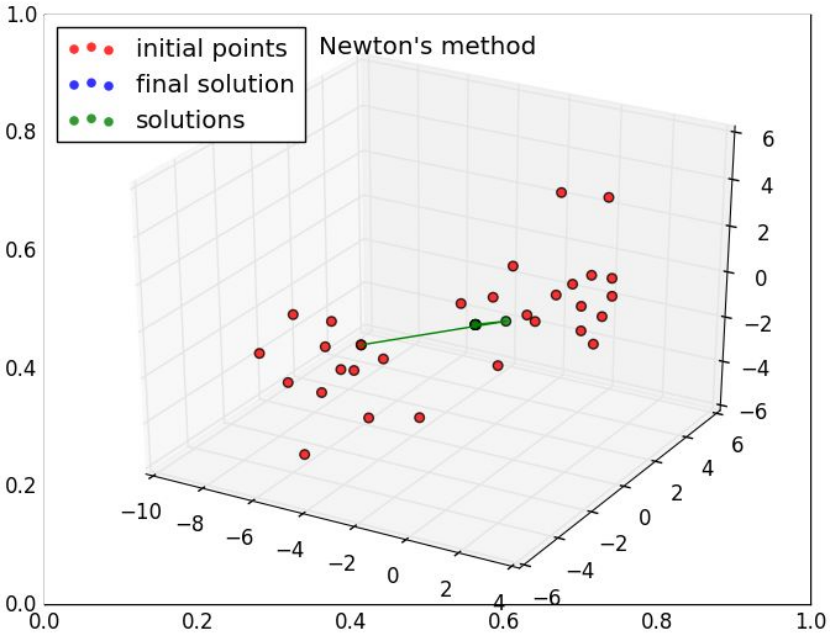

1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.2
0.4
0.6
0.8
1.0
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−5
0
5
10
15
20

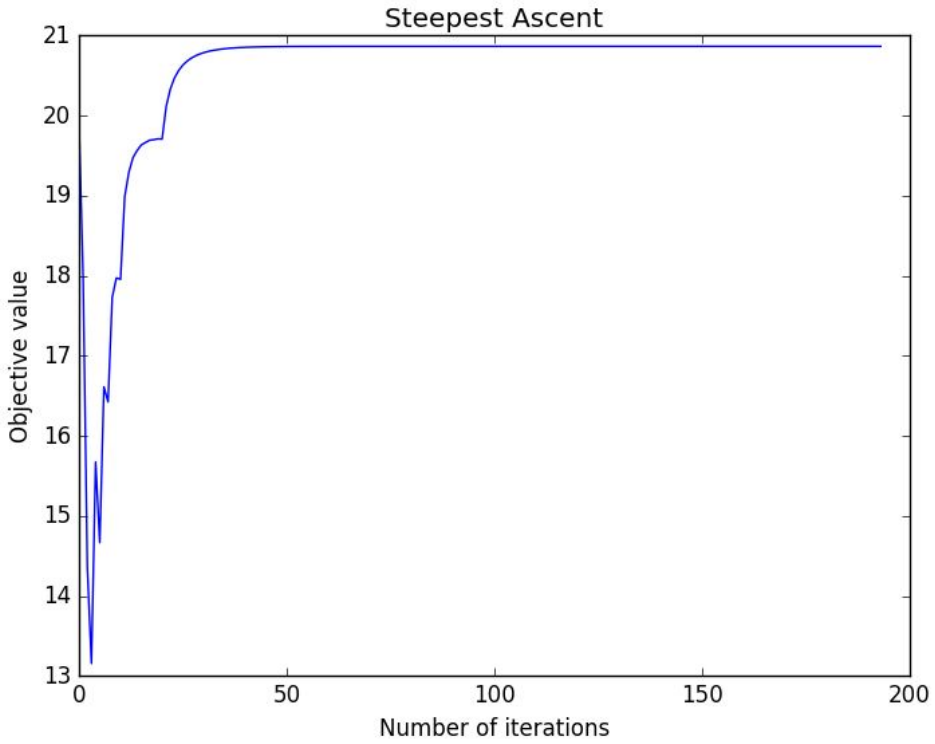

1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.2
0.4
0.6
0.8
1.0
−5
0
5
10
15
20
20
15
10
5
0
−5
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5

Problem 3

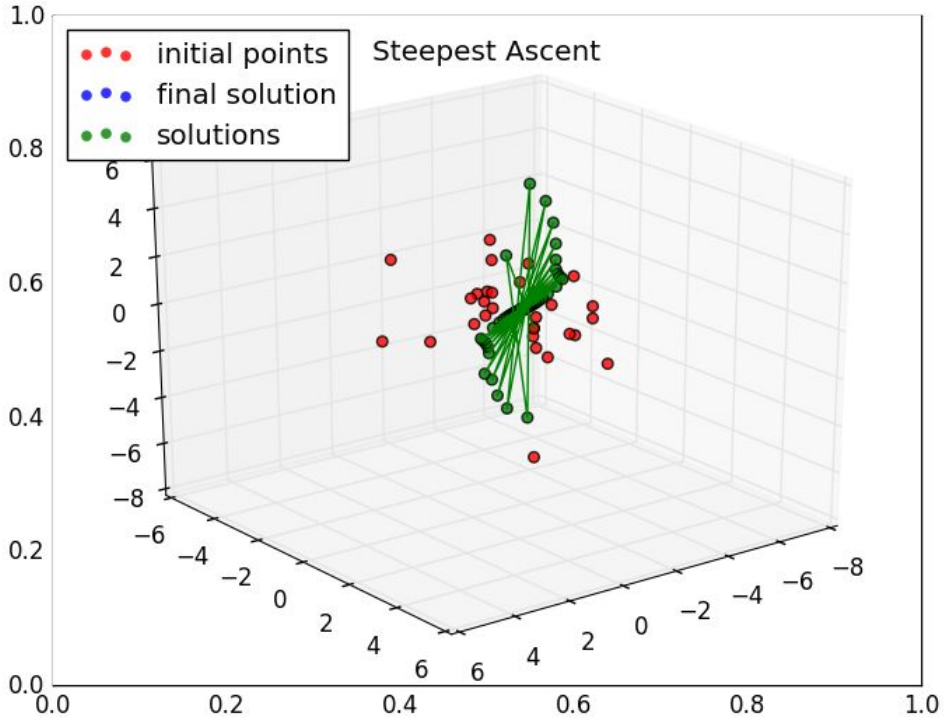
I tackled the problem in R^3 with steepest ascent and Newton's method. I plotted the objective function vs. number of iterations. The second plot is of intermediate solutions to reach the final solution and the input points. Newton's method converges with fewer steps compared to steepest ascent.

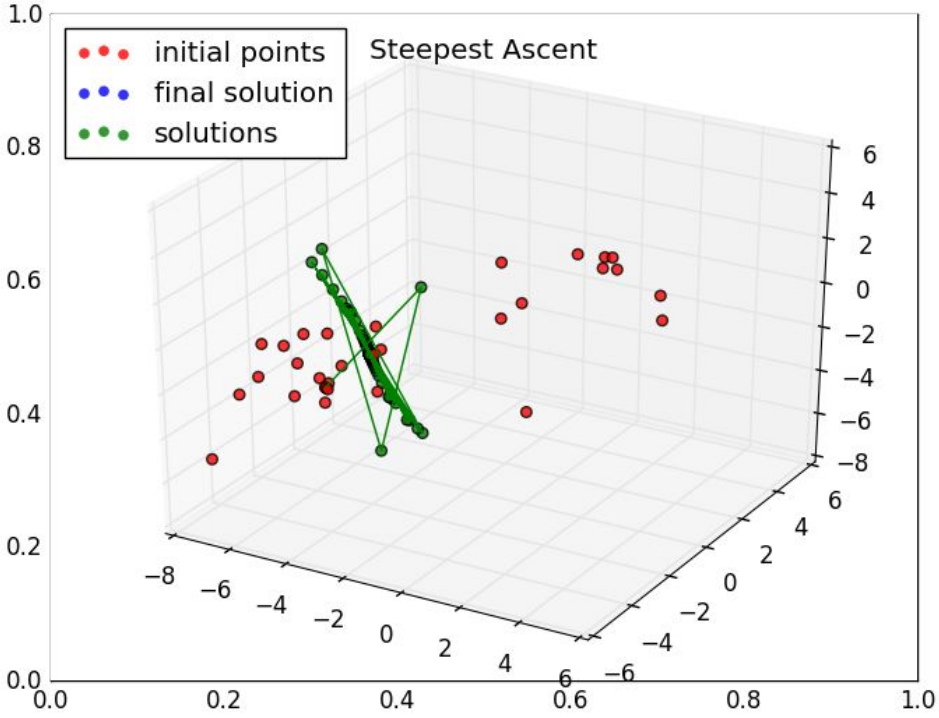

Newton's method
Objective value
Number of iterations
20.5
20.0
19.5
19.0
18.5
18.0
17.5
0
1
2
3
4
5

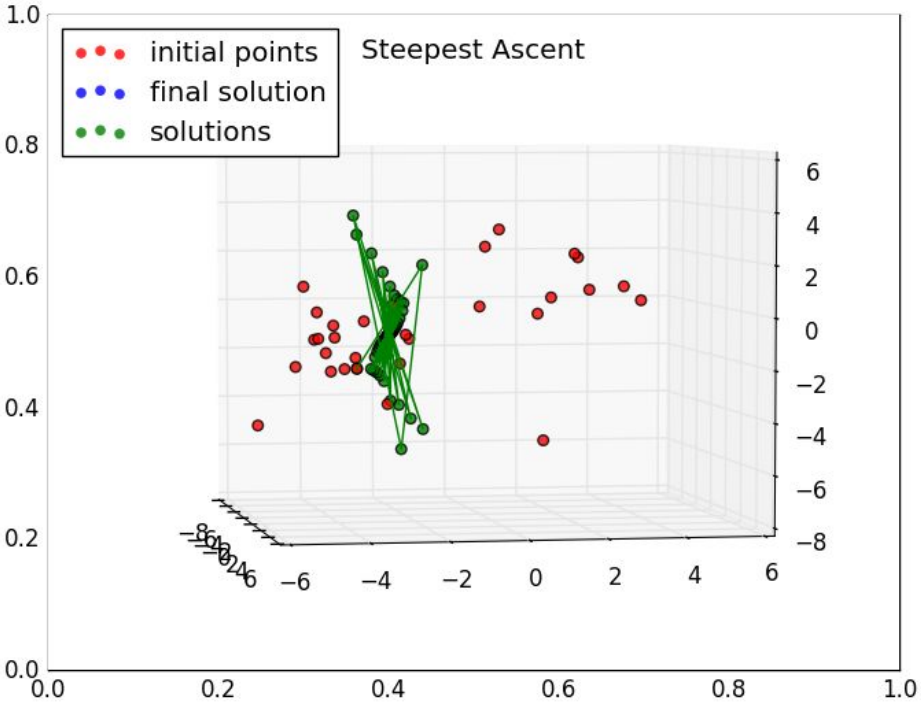

initial points
final solution
solutions
Newton's method
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.2
0.4
0.6
0.8
1.0
−10
−8
−6
−4
−2
0
2
4
6
4
2
0
−2
−4
−6



Different views of the same plot:




initial points
final solution
solutions
Steepest Ascent


initial points
final solution
solutions
Steepest Ascent