Homework 11

-Drumea Calin-Matei

This is my code:

A computer screen shot of a program code

Description automatically generated  
  
The errors are there because haven’t yet added an A matrix.

Firstly, I imported the necessary libraries for plotting the function (matplotlib) and for numerical operations (numpy)

Then I defined the f function, which calculates, in easier terms, f(x) = ½ \* x^T \* A \* x. The “dot” function is a predefined function in numpy that calculates the dot operation between two variables, taking account if they’re vectors of any size.

I then defined the gradient function that, of course, calculates the gradient of f(x).

Now before the main code, we need to take an A matrix for each subproblem. The ones that I chose are: A = ([[2, 1], [1, 3]]) s.t. f has a unique minimum (symmetric matrix with positive eigenvalues), A = ([[-2, -1], [-1, -3]]) s.t. f has a unique maximum (symmetric matrix with negative eigenvalues) and A = ([[2, 1], [1, -2]]) s.t. f has a unique saddle point (both positive and negative eigenvalues).

Now the rest of the code is just generating a grid of points, choosing 3 random points for gradient calculation, creating and plotting the 3D graph and setting the labels.

Now the resulted graphs are:

A graph of a surface plot with contour lines and gradient

Description automatically generated(for the first A)

A graph of a surface plot with contour lines and gradient

Description automatically generated(for the second A)

A graph of a graph of a curve

Description automatically generated with medium confidence(for the third A)

The link to the GitHub repository: https://github.com/drmatei/Analysis