Math 251: Computational Lab 4

Fall 2019, Sections 1-3

Instructor:	Matt Charnley
Recitation Instructor:	Some TA
Due Date:	September 1, 2019

Introduction

You are encouraged to discuss this assignment with other students and with the instructor/recitation instructor, but the work you hand in should be your own. See the website

http://math.rutgers.edu

for more information as well as helpful background information and commands for completing the assignment.

While problems you have dealt with so far in class only have up to three variables, problems in the real world can have much more than that. In this lab, you will deal with a problem in 4 variables and see how the standard optimization techniques can be used on this problem.

Your Task

For this assignment, the individualized data from your instructor will consist of two functions $f(w, x, y, z)$ and $g(w, x, y, z)$. With this information, your goal will be to find the maximum value of $f(w, x, y, z)$ with respect to the constraint $g(w, x, y, z) \leq 1$. To do this, you need to:

- Find points where the gradient of f is zero, and check to see if these points are within the desired domain.

- Use Lagrange multipliers to determine the critical points along the boundary of the domain.

- Figure out where the maximum value of f is attained and what this maximum value is.

Deliverable

Your code should consist of the following:

1. Storing the two functions f and g.

2. Finding (and displaying) all possible 'interior' critical points by finding points where the (4-dimensional) gradient of f is zero. Determine which of these points lie within the constrained region.

3. Use Lagrange multipliers (again in 4-dimensions) to determine the potential critical points along the boundary $g(w, x, y, z) = 1$.

4. Find the value of f at each of these points, determine the maximum and minimum value, along with at which of the critical points it is attained.

Print all of your code (after removing all of the incorrect lines) and the desired images from above and put them into a single stapled packet. This assignment is due on **September 1, 2019** in recitation.

Rubric

This lab is worth a total of 15 points.

- 3 points for including the supporting code for all of the points below.

- 2 points for identifying all critical points of the objective function.

- 2 points for determining whether or not these points are valid (i.e., if they satisfy the desired inequality constraint).

- 2 points for setting up the Lagrange multiplier problem.

- 2 points for finding all solutions to the Lagrange multiplier problem. You do not need to show all of the solutions, just display the number of solutions on the boundary.

- 2 point for evaluating the objective function at all critical points and solutions to the Lagrange multiplier problem.

- 2 point for identifying the appropriate maximum and minimum of the objective function.