MTH 377/577 CONVEX OPTIMIZATION

Winter Semester 2022

Indraprastha Institute of Information Technology Delhi

Coding Assignment

Submission Time: May 1 (Sunday midnight); Total Points: 20

Instructions

1. Please provide your solutions as a jupyter notebook.
2. Please run your cells and save the outputs of the jupyter notebook before submitting it. It should be the case that the TAs can grade your notebook without running it, using the outputs saved.
3. Please scan your written work and keep it in the same folder as the jupyter notebook.
4. Please contact the TAs in case of any doubts.

Problem 1 posted on Feb 8. (10 points). Consider the following optimization problem:

$$\min_{x,y} f(x,y) = 3x^2 + y^4$$

(a). Apply one iteration of the gradient descent algorithm with $(1, -2)$ as the initial point and with the parameters $\alpha = 0.1$ and $\beta = 0.5$

(b) Repeat (a) using $\alpha = 0.1$ but $\beta = 0.1$ instead. How does the f - value of the new iterate compare to that in (a). Comment on the tradeoffs involved in choice of β.

(c) Apply one iteration of Newton descent algorithm with the same initial point and stepsize selected using backtracking line search. How does the f- value of the new iterate compare to that in (a). How about the amount of work involved in finding the new iterate.

(d) Solve the problem computationally - once by running gradient descent algorithm, and once by running the Newton descent algorithm. Report all parameters used in the two algorithms and the number of iterations to convergence.

Problem 2 posted on Apr 22. (10 points). Solve the following equality-constrained optimization problem using Newton descent algorithm with the initial point $(1, 4, 0)$:

$$\begin{aligned} \min_{x,y,z} \; & f(x, y, z) = e^x + 2y^2 + 3z^2 \\ \text{subject to } & x - 5z = 1 \\ & y + z = 4 \end{aligned}$$

Compute the optimal dual variables as well.