ISyE 6669 HW 1

Fall 2021

1. Consider the following maximization problem

$$\max \quad (x-1)^2 + (y-1)^2$$
$$\text{s.t.} \quad |x| + |y| \leq 1.$$

   Plot the feasible region of this problem with the feasible area shaded. Draw (in dashed lines) the contours of the objective function. Based on your drawing, find all the optimal solutions and the optimal objective value of this problem. There may be multiple optimal solutions. Find all optimal solutions.

2. Recall the maximum volume box from Module 1, Lesson 1. Solve the following problem using basic calculus:

$$\max\{x(1-2x)^2 : \ 0 \leq x \leq 1/2\}$$

   What is the optimal solution and the optimal objective value? Draw the objective function over the feasible region.

3. Consider the following optimization problem:

$$(P) \quad \max \quad x(y^2 - z^2)$$
$$\text{s.t.} \quad |y| + z \leq 1,$$
$$x \in \{0, 1\}, \ z \geq 0.$$

   Answer the questions:

   (a) Is (P) a linear program, a mixed integer nonlinear program, or a mixed integer quadratic program? Choose all descriptions that apply.

   (b) Write a minimization problem that is equivalent to (P).

   (c) Find all the optimal solutions.

4. Recall the portfolio optimization problem solved in Module 2, Lesson 3. Now, collect the prices of MSFT, V, and WMT from the last 24 months (data can be collected from e.g. Yahoo Finance). Use the code and data file format used in the lesson (this will be provided) to solve the exact same portfolio problem using the new data. Compare and contrast your solution to the one in the lesson.