

# ISyE 6669 HW 1

Fall 2025

1. Consider the following maximization problem

$$\begin{aligned} \max \quad & x^2 + (y - 1)^2 \\ \text{s.t.} \quad & x + 2y \leq 6 \\ & x - y \leq 0 \\ & x \geq 0, y \geq 0. \end{aligned}$$

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. Solve the following problem using basic calculus:

$$\max\{-10x + 5x^2 + 9x^3 + 8x^4 + 7x^5 : -1 \leq x \leq 1\}$$

What is the optimal solution and the optimal objective value? Are there any local maxima that are not global maxima?

3. Consider the following optimization problem:

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

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. Use the provided code file (`portopt_cvxpy_python3_HW1.py`) and provided data file `monthly_prices_HW1.csv` to solve the exact same portfolio problem using this new data. Compare and contrast this new solution to the one obtained in the lesson.