TEXAS
The University of Texas at Austin

TOPIC 3 NONLINEAR PROGRAMMING - QP

Quadratic Objective

- If the non-linear objective has a very special form:
  - $x_1^2 + 2x_2^2 + 4x_3^2 + x_1x_2 - 3x_1x_3 + 2x_2x_3 - 4x_1 + 2x_2 - x_3$
- Then gurobi can solve the problem for us!
- Constraints still need to be linear (QCP)
  - $a_1x_1 + a_2x_2 + a_3x_3 \leq b$
- This is a special type of NLP is called quadratic programming

Regression

- Does regression fit the bill of quadratic programming?
- $\min_{\beta} \sum_{i=1}^{n} (\beta_0 + \beta_1 x_i - y_i)^2$
- This can be rewritten as
- $\min_{\beta} \sum_{i=1}^{n} \left(\beta_0^2 + \beta_1^2 x_i^2 + 2\beta_0\beta_1 x_i + y_i^2 - 2\beta_0 y_i - 2\beta_1 x_i y_i\right)$
- $\min_{\beta} n\beta_0^2 + \beta_1^2 \sum_{i=1}^{n} x_i^2 + 2\beta_0\beta_1 \sum_{i=1}^{n} x_i - 2\beta_0 \sum_{i=1}^{n} y_i - 2\beta_1 \sum_{i=1}^{n} x_i y_i + \sum_{i=1}^{n} y_i^2$