

Assignment 3

EE 553 Power System Economics

Due April 19, 2017 at 8pm. Email to ywang11@uw.edu

Problem 1. Consider the following optimization problem:

$$\text{minimize } x_1^2 + 0.5x_2^2 + 0.25x_3^2 \quad (1a)$$

$$\text{subject to } 0.5x_1 + x_2 = 10 \quad (1b)$$

$$0.5x_1 + x_3 = 20 \quad (1c)$$

Solve this optimization problem and find the multipliers associated with each of the equality constraints. Give a physical interpretation for both of the multipliers. Hint: think about an example with 3 power plants and two loads.

Problem 2. Consider the following optimization problem:

$$\text{minimize } x_1 + x_2 \quad (2a)$$

$$\text{subject to } 2x_1 + x_2 \geq 10 \quad (2b)$$

$$x_1 + 2x_2 \geq 5 \quad (2c)$$

Solve for x_1 and x_2 . Graphically present your solution: draw the region represented by the two inequality constraints and indicate the optimal point.

Problem 3. A small power system is supplied by four generators. The cost characteristics of these generators are given by (the powers are expressed in MW):

$$C_1 = 300 + 12P_1 + 0.05P_1^2 \quad [$/h]$$

$$C_2 = 250 + 13P_2 + 0.06P_2^2 \quad [$/h]$$

$$C_3 = 150 + 11P_3 + 0.08P_3^2 \quad [$/h]$$

$$C_4 = 200 + 10P_4 + 0.07P_4^2 \quad [$/h]$$

Calculate the economic dispatch (find the output of the generators) for the case where the total load on the system is equal to 800 MW.

1. Suppose that the first generator is limited between 100MW and 200MW ($100 \leq P_1 \leq 200$) and the second generator is limited between 50MW and 150MW ($50 \leq P_2 \leq 150$). Find the optimal solution by hand using the techniques of multipliers. Indicate which constraints are tight at optimum.
2. Suppose generator 3 and 4 have constraints $100 \leq P_3 \leq 300$ and $150 \leq P_4 \leq 300$, respectively. Using Julia (see tutorial on course website) or Matlab (google linear constrained QP in Matlab if you're not familiar with the programming) to solve this. Hand in a copy of your (commented) code.