University of Tabriz

Faculty of Electrical and Computer Engineering

First HW, Optimization of Power Systems Course Due date: April 9, 2016

1- Plot the feasible region for the following optimization problem and find the optimal solution.

a)

Minimize $z = -4x_1 + 7x_2$

Subject to

$x_1 + x_2 \geq 4$

$-x_1 + x_2 \leq 3$

$2x_1 + x_2 \leq 9$

$x_1 , x_2 \geq 0$

b)

$$\text{Maximize} \quad x_1 + 3x_2$$

$$\text{Subject to} \quad -x_1 + x_2 \leq -1$$

$$-2x_1 - 2x_2 \leq -6$$

$$-x_1 + 4x_2 \leq 2$$

$$x_1, x_2 \geq 0$$

C)

Maximize $20X_1 + 10X_2$

Subject to: $5X_1 + 4X_2 \leq 250$

$2X_1 + 5X_2 \leq 150$

$X_1, X_2 \geq 0$

2- *A firm producing a product P has two plants. Each plant produces 90 tons of P monthly, and the product is distributed in three different markets. Table 1 shows the unit cost of shipping 1 tons of product P from a given plant to a given market. The firm wants to send the same number of tons to each market and minimize the total cost. Formulate the corresponding liner programming problem and use GAMS to solve it.*

Table 1: Distribution problem

MARKETS			
Plants	*Market 1*	*Market 2*	*Market 3*
Plant 1	*1*	*3.5*	*5*
Plant 2	*2*	*4.5*	*4*

3- Formulate the transmission line constrained economic dispatch (ED) problem for the following network. Please use DC power flow for this purpose. Use GAMS for solving the problem.

Consider a 3 bus 3 line system (see Figure 1.5) . The generator of bus 1 produces at cost 6 and it lower and upper limits are respectively 0.15 and 0.6 . The production cost of the generator of bus 2 is 7 and its power limits are respectively 0.1 and 0.4 . line 1-2 has a susceptance 2.5 and a maximum transmission limit of 0.3 ; line 1-3 a susceptance of 3.5 and a transmission limit of 0.5 ; and finally line 2-3 a susceptance of 3.0 and a transmission limit of 0.4 . This system has a single demand located in bus 3 with a value of 0.85 . A one hour time period is considered . The origin is taken in bus 3 .

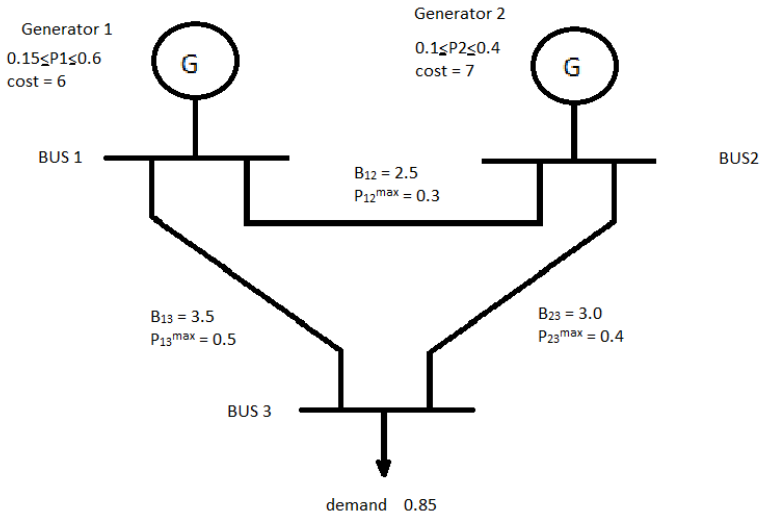

Figure 1.5 : Illustration of the economic dispatch ploblem

4- For the following problem:

A: Find all of the basic feasible solutions.

B: Find the optimal solution using Simplex method:

$$\textit{Minimize} \qquad f = -x_1 + 2\,x_2$$

$$\textit{Subject to :} \qquad 2x_1 - x_2 \geq 2$$

$$-x_1 + 3x_2 \geq -2$$

$$-x_1 - x_2 \geq -4$$

$$x_1 \geq 0\ ,\ x_2 \geq 0$$

5-

$$\underset{x_1, x_2, x_3, x_4}{\text{minimize}} \qquad z = 3x_1 + x_2 - x_4$$

subject to

$$\begin{array}{rrrrcr} x_1 & +x_2 & -x_3 & -x_4 & = & 4 \\ 2x_1 & -x_2 & & +x_4 & \leq & 0 \\ & 3x_2 & +x_3 & -2x_4 & \geq & 1 \\ & & & x_1, x_2 & \geq & 0 \\ & & & x_4 & \leq & 0\,. \end{array}$$

Build the dual problem, solve both problems, and check that the optimal values coincide.

6- Repeat question 5 for the following problem:

$$\begin{aligned} \max \quad & 3\pi_2 + 6\pi_3 \\ \text{s.t.} \quad & 2\pi_1 + 3\pi_2 - \pi_3 \geq 1 \\ & 3\pi_1 + \pi_2 - \pi_3 \leq -1 \\ & -\pi_1 + 4\pi_2 + 2\pi_3 \leq 0 \\ & \pi_1 - 2\pi_2 + \pi_3 = 0 \\ & \pi_1 \leq 0, \pi_2 \geq 0 \end{aligned}$$