EE/Econ 458: HW 7, Due Wednesday Oct 26

A. You solved the following optimization problem in HW6. Using the same system you analyzed in problem 1, shown below, set up the optimal power flow as a linear program. Assume the objective function is the same as used in the example in class when we investigated the case of demand bidding, i.e.,
$Z = 1307P_{g1} + 1211P_{g2} + 1254P_{g4} - 1300P_{d2} - 1200P_{d3}$. Also, assume (as in HW6) each generator has a lower limit of 100 MW and an upper limit of 300 MW, which will be (in per unit):

$1 \le P_{g1} \le 3$

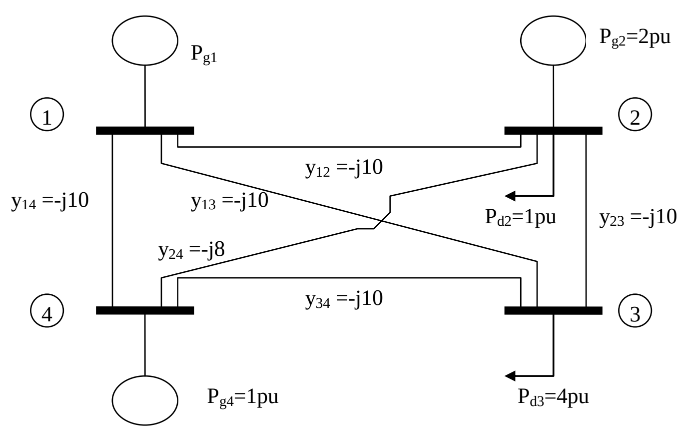
$1 \le P_{g2} \le 3$

$1 \le P_{g3} \le 3$

and the loads are constrained as follows:

$1 \le P_{d2} \le 2$

$1 \le P_{d3} \le 3$



<u>Problem A1</u>: Provide the objective function and all solution variables and dual variables at the optimal solution. Also identify the settlement, i.e., identify how much each load pays and how much each generator pays.

<u>Problem A2</u>: Now constrain the flow on branch 3 to $P_{b3}=P_{23}=0.45$ pu and resolve. Provide the objective function and all solution variables and dual variables at the optimal solution. Also identify the settlement, i.e., identify how much each load pays and how much each generator pays. Finally, compute the congestion charges

as the difference between total load payments made and total generator payments received, and using the dual variable of the constrained branch.

B. Using branch-and-bound to solve problem B1 and problem B2. For both problems:

a. Solve them using successive LP-relaxations, where each LP-relaxation is solved using the CPLEX LP-solver.
b. Solve them using the CPLEX MIP-solver.

Problem B1:
Max $z = 5x1 + 2x2$
s.t. $3x1 + x2 \leq 12$
$x1 + x2 \leq 5$
$x1, x2, \geq 0$; $x1, x2$ integer

Problem B2:
Max $z = 3x1 + x2$
s.t. $5x1 + 2x2 \leq 10$
$4x1 + x2 \leq 7$
$x1, x2, \geq 0$; $x2$ integer