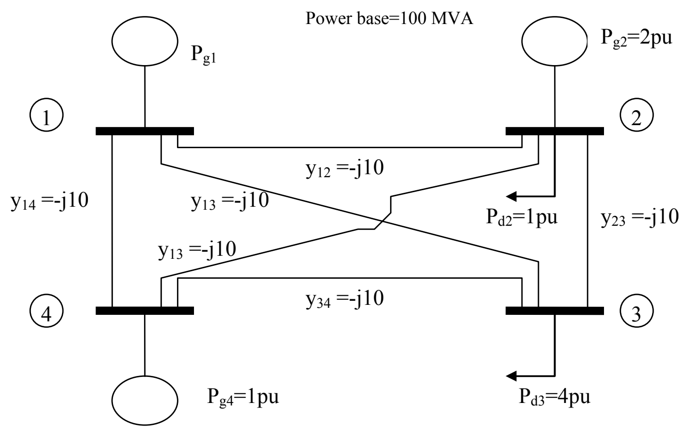
EE 458, Spring 2008, HW6, Due 3/24/08

1. Using the same system that you analyzed in HW5, provided again below for your convenience, compute the $\underline{T}$ matrix of generation shift factors for every branch. Make the computation in two different ways:
   a. Assume bus 1 compensates for all changes, i.e., bus 1 is the slack bus.
   b. Assume a distributed slack, with all buses compensating equally.
   c. In part III of HW5, you computed the flows for a change in generation at bus 2 from 2 to 4 per unit. You should get the same answer using elements of the $\underline{T}$ matrix computed from either part (a) or part (b). Which part? Perform the calculations for each branch to get the new branch flow using the original branch flow and the change in branch flow, where the change in branch flow is computed from the appropriate elements of the appropriate $\underline{T}$ matrix. Then compare your answer based on $\underline{T}$ matrix elements to the answer you obtained in HW5.



2. Assume that, for the system used in #1 above, the losses are approximated by

$$Losses = 0.02P_{d2} + 0.03P_{d4}$$

Assume the offers made by the three units are:

s_1=13.07 \$/MWhr, $0 \le P_{g1} \le 300$ MW
s_2=12.11 \$/MWhr, $0 \le P_{g1} \le 200$ MW
s_4=12.54 \$/MWhr, $0 \le P_{g1} \le 100$ MW

   a. Use the specified loss function to compute the system losses for the loading given in the above figure, and then indicate what the total generation needs to satisfy this demand and corresponding losses.
   b. Plot the composite offer curve (i.e., the inverse supply function), similar to Fig. 1 in the notes LPOPF1, for the above three offers. Draw a vertical line corresponding to the total generation necessary to satisfy demand and losses, and indicate which unit is on the margin.
   c. Determine the nodal prices at the two load buses, accounting for losses (but ignoring congestion).
   d. Assume now that the circuit #5 (the one from bus 1 to bus 3) is at its limit, with its corresponding Lagrange multiplier being μ_5=\$0.86/MWhr. Using appropriate elements from the T-matrix, as computed in problem 1 above, compute the LMPs for buses 2 and 4, including the effects of losses as computed in part c.

3. Based on the first letter of your last name, you are assigned to go to one ISO website and find at least one month's history of LMPs. The assignments are given below.

ERCOT: A-E
MISO: F-J
NYISO: H-K
PJM: L-O
CAISO: P-S
ISO-NE: T-Z

I believe you should be able to find them for all ISOs, but if you cannot for your assigned ISO, choose an ISO just above or below your assigned one.

Choose a node (in some ISO's you may only see zonal LMPS, in this case, choose a zone) for which the LMPs appear to vary a lot with time. Although you are free to choose any month, I suggest to choose a summer month if you can (you can choose to analyze more than one month's data if you like, but you must analyze at least one month's data). Download the data.

Use the data to compute the CHANGE in LMP from one hour to the next, i.e., $\Delta(t)=LMP(t)-LMP(t-1)$. You should be able to use a spreadsheet to do this fairly easily. Plot $\Delta(t)$ vs. t for your data. Also, compute the average $|\Delta(t)|$ for your data. Provide a discussion regarding what you think is causing the variation in LMPs.