HW9, Due 5/2/08

Starting from the CPLEX file provided on the website (4/16/08, Modified UC24 Data called UC24a.lp), add appropriate code to model the following additional constraints.

1. Reserve margin: Spinning reserve should be, in any hour, according to $\sum_i r_{it} \geq 0.1 \times D_t$, and $r_{it} \leq z_{it} \times 0.15 \times MAX_i$. Note that these replace constraints (3) and (6) in our formulation. Note also that these constraints are on the *units*, not on individual *offers*. You should compare the 24-hour UC solution with and without these constraints. Identify any differences. Provide the solution in terms of a plot of unit dispatch vs. time for all three units.

2. Ramp rates: Assume for all three units that $MxInc_i=MxDec_i$=0.2 pu. Note that these affect constraints (7) and (8) in our formulation. You should compare the 24-hour UC solution you obtain with these constraints modeled with the solution you obtained in #1. Identify any differences. Provide the solution in terms of a plot of unit dispatch vs. time for all three units.

3. Line flow constraints: Assume the total load equally divides between buses 2 and 3.

    a. Determine the a_{ij} for this network under the assumption of a distributed slack bus (see "sensitivity.doc" notes and "sensitivity-update.doc" notes), where a_{ij} is the linearized coefficient relating bus *i* injection to line *k* flow.
    b. Implement constraint (11) in your CPLEX code.
    c. Assume all lines are constrained to the same pu flow, call it MxFlow. Identify the minimum value of MxFlow for which the solution to problem 2 is unaffected. A lower bound to this value would be the maximum branch flow among all branches when the load is maximum (maximum load over all 24 hour periods is 3.4 pu). It could be higher than this (since lower values of loading may have different units committed), but to find out you will have to re-solve the UC with this value of MxFlow implemented. If the UC solution changes (either in terms of which units are committed or in terms of dispatch), then increase MxFlow a little and resolve the UC. Repeat until you identify the minimum value of MxFlow for which the solution to problem 2 is unaffected.
    d. Identify the UC solution for MxFlow=90% of the value identified in part (c). Provide the solution in terms of a plot of unit dispatch vs. time for all three units.