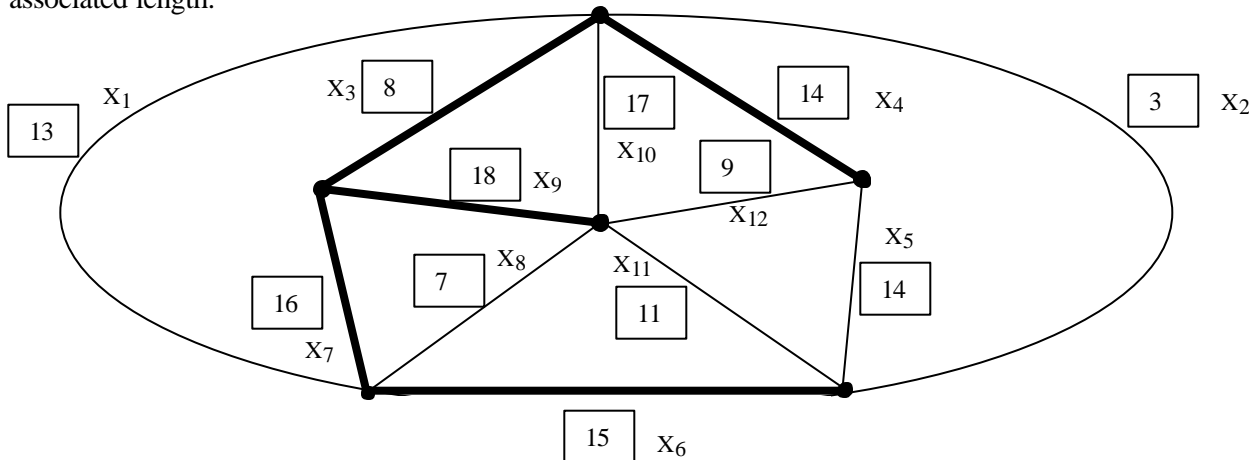


MAE 552  
 Homework #4  
 Due date: Friday April 5th

Refer to the following diagram that represents an electrical power grid. The goal of this assignment is to use Tabu search to find the minimum-spanning tree (MST) that is the cheapest subset of edges that keeps the network in one connected component. A valid spanning tree has  $n-1$  branches where  $n$  is the number of nodes. The edges are labeled  $X_1$ - $X_{12}$  and each is given an associated length.



This cost tree is subject to the following two constraints (edges are 1 if present and 0 if not when evaluating the constraints) and the unit violation penalty is 25:

$$X_6 \leq X_{10}$$

$$X_4 + X_2 \leq 2X_5$$

The initial solution to this cost tree is shown in bold. The total cost corresponding to the initial solution is (branch cost  $\{8+14+18+16+15=71\}$  + constraint violation  $\{2*25\}=121$ ). Attempt to find the minimum cost solution to this problem using Tabu Search. Your Tabu Search is subject to the following parameters:

*Choice Rule:* Edge Swap

*Tabu Restriction:* cannot drop either of the two previously added edges

*Aspiration criteria:* override tabu restrictions if an 'overall best' solution can be obtained by doing so.

- Perform 4 full iterations, **clearly showing the details of your decision process each iteration**, as was done in the example in class. It would be beneficial to create a candidate list of moves each iteration. Be thorough and neat, denote a tabu list each iteration and explain which constraints are violated each iteration.
- Is your result from part a) the optimal spanning tree for this problem? If not, identify a better spanning tree by inspection and explain why you think that your Tabu search did not arrive at this solution in 4 iterations.
- Tabu search is a heuristic optimization techniques. Keeping this in mind, and taking into account your answers to parts a) and b), briefly comment on the following questions: What did Tabu search accomplish for you in this example? For larger problem say a spanning tree with 500 branches, do you think that Tabu search would be more or less useful than in this example.