CS532c Fall 2004: Homework 4

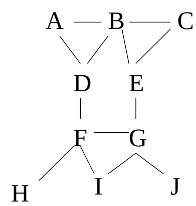
Out Wed 6 Oct, Due Mon 18 Oct

1. Download HW4.zip and then tmplement the following functions in Matlab:
   (a) `UG = moralize(DAG)`
   (b) `order = elimOrderGreedy(UG, sizes)`. The algorithm should try to eliminate the first simplicial node (one that is connected to all its uneliminated neighbors, so that no fill-in edges are necessary); if there are no such nodes, it should eliminate the node that results in an induced clique of minimal weight, where the weight of a clique is the product of the sizes of the nodes it contains:

   $$w(C) = \prod_{i \in C} s(i)$$

   where $s(i)$ = sizes(i) is the number of values node i can take on.
   (c) `[GT, cliques, fillIns] = triangulate(UG, order)` that triangulates an undirected graph with the specified order. This returns the triangulated version, the maximal cliques, and the fill-in edges.
   (d) `J = jtreeFromMaxCliques(cliques)` that builds a junction tree from the maximal cliques of a chordal graph. You may use the provided function `minSpanTree`.

2. Consider the undirected graph below. Suppose all nodes have size 2, except for the following: $D = 4, E = 5, F = 6, G = 7$.



   (a) What elimination ordering does your function `elimOrderGreedy` produce in this case? What is the sum of the weights of the cliques?
   (b) Construct a better elimination ordering; what is the sum of the weights of the cliques in this case?

   You might find the function `hw4-q1.m` helpful.

3. Construct an optimal junction tree (i.e., one which minimizes the sum of the clique weights) for the Bayes net below. Assume all nodes have the same size (weight). Note: The answer may not be unique. You can verify correctness using `jtreePropertyCheck(jtree, cliques)`. How can you be sure your answer is optimal in this case?