Assignment 4

Available Since: May 15, 2015   Due Date: May 21, 2015, 12:00 a.m.
You are permitted and encouraged to work in groups of two.

Exercise 1: 10 Points
Implement an algorithm to construct the decomposition tree of a series-parallel graph.
**Hint:** Label all edges in the graph, and start by representing them as Q-nodes in the decomposition tree. Then build the tree bottom-up by performing series or parallel reductions.

- Use class name `lastname1_lastname2.a03.DecompositionTree`
- Label the nodes in the decomposition tree with S, P, or Q, and the s and t vertices of the corresponding subgraph (using the `Graph2D.setLabelText(Node, String)` method).
- Apply your algorithm to both SP-graphs in the materials folder (using file -> load in the interface), and submit pictures of the resulting decomposition trees with the theoretical assignments.

Exercise 2: Strongly Connected Graphs 5 Points
A directed graph $G = (V, E)$ is strongly connected if for any pair $v, w$ of vertices there exists a directed path from $v$ to $w$. Prove or disprove the following statements for $|V| \geq 3$.

(a) The edges of a biconnected undirected graph can be oriented such that the resulting directed graph is strongly connected.

(b) The underlying undirected graph of a strongly connected graph is biconnected.
Exercise 3: 5 Points

Compute the biconnected components of the following graph, using the algorithm presented in the lecture. Show your steps like we did in the lecture, including changes in the stacks $S$ and $C$. 