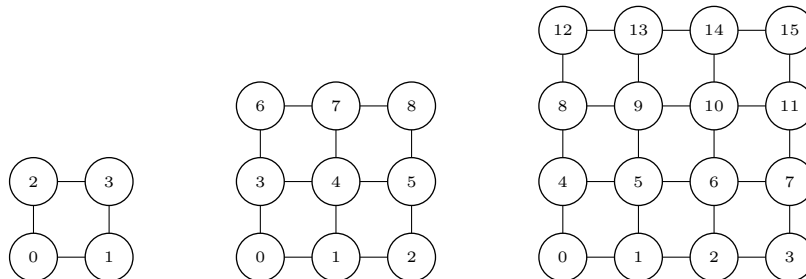


Homework 2: due 15:30, 26-April-2016

- (1) **(3 points)** Determine the treewidth of the following three graphs.



- (2) **(2 points)** Skim through the paper [1], and draw the dependency graph of its lemmas, theorems, corollaries and propositions.
- (3) **(5 points)** Using the statements already proved in [1], prove that the correctness of the main algorithm in Section 5 in [1].
- (4) **(5 points)** Prove that non-deterministic (bottom-up) tree automata can be converted to an equivalent deterministic tree automata.
- (5) **(5 points)** Describe a linear-time algorithm for the following Hamiltonian circuit problem, with k being a constant:

Input: A graph $G = (V, E)$ of treewidth k .

Task: Output “Yes,” if G has a Hamiltonian circuit. Otherwise, output “No.”

Appendix

If you access it through the university internet, you can download paper [1] in <http://epubs.siam.org/doi/abs/10.1137/S0097539793251219>,

Note that Theorem 2.4 in [1] is actually proved in [2], which you don’t need to read for question (2).

References

- [1] H. L. Bodlaender. A linear-time algorithm for finding tree-decompositions of small treewidth. *SIAM Journal on Computing*, 25(6):1305–1317, 1996.
- [2] H. L. Bodlaender and T. Kloks. Efficient and constructive algorithms for the pathwidth and treewidth of graphs. *Journal of Algorithms*, 21(2):358–402, 1996.