Prof. Dr. Christian Scheideler   Paderborn, April 8, 2019
Universität Paderborn

Advanced Distributed Algorithms and Data Structures
SS 2019
Homework Assignment 1

Problem 1:
Prove Theorem 2.7. (Hint: Determine an upper bound on how many nodes can be reached by a path of length ℓ from node v in a graph of maximal degree δ.)

Problem 2:
Prove Theorem 2.8. (Hint: Generalize the definition of the d-dimensional de Bruijn graphs on slide 20 of chapter 2 to a family of b-ary de Bruijn graphs, i.e., $V = \{0, \ldots, b-1\}^d$, and determine the degree and diameter of these graphs.)

Problem 3:
Consider the synchronizer α on slide 39 of chapter 2.

(a) Formally show (by induction) that the round numbers of two neighboring nodes never differ by more than 1 at any time.

(b) Use (a) in order to bound the maximum difference the round numbers of two nodes can have at any time in a connected undirected graph $G = (V, E)$. (Hint: use a suitable graph parameter.)