

Exercise No. 4
Peer-To-Peer Networks
Summer 2008

Exercise 7 *Network diameter*

Let D the diameter of an arbitrary network of n nodes and a degree bounded by c .

1. Show that $D \geq \frac{\log n}{\log c}$. *Hint: Approximate the maximum number of nodes reachable within s steps.*
2. Consider the different peer-to-peer networks in the lecture so far. How do they compete with this bound?
3. What is the minimum degree of a network, if the diameter is 2?

Exercise 8 *k-connectivity*

Connectivity is an important property for peer-to-peer networks. A graph is called k -connected, iff at least k disjoint paths exist between any two nodes.

1. How many disjoint paths between two arbitrary nodes exist at least in CAN, if
 - no fragmentation is allowed, and
 - fragmentation is possible? *Hint: Think about the worst case!*
2. Consider a perfect Chord ring, i.e. all 2^m positions are occupied by exactly one peer, $n = 2^m$. Find at least three disjoint paths from a peer A to a peer B !
3. There are two different possibilities to create the routing table of a joining peer in Pastry. Consider them with respect to k -connectivity of the resulting graph structure and discuss which one is preferable!