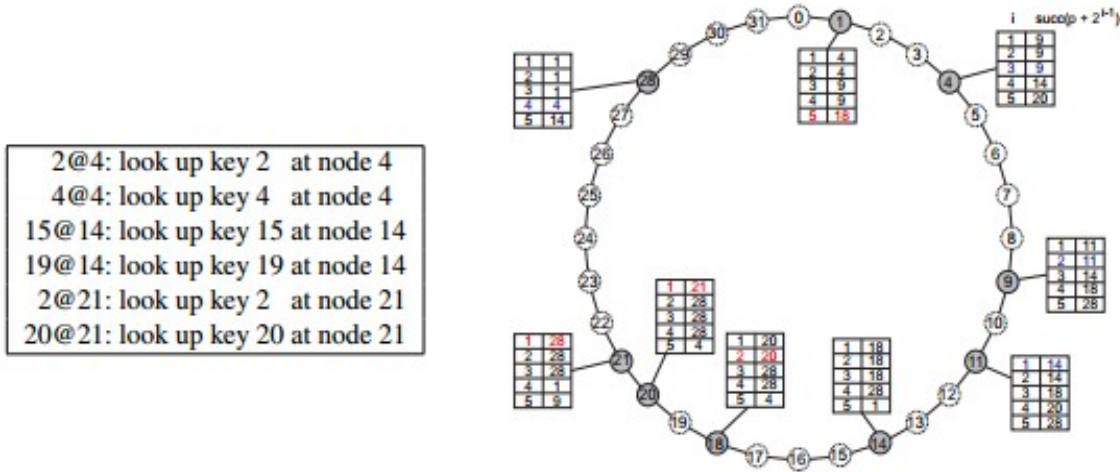
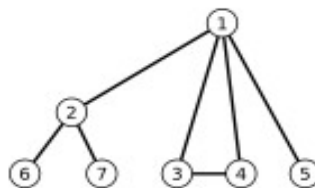


Peer to Peer Systems 15/01/2014
Master Degree in Computer Science, Computer Science and Networking,
Business Informatics

1) Resolve the following key lookups for the following Chord overlay (4pt)



2) Compute the clustering coefficient of the vertex 1 and of the graph T. Explain your answer. (4pt)



3) The definition of an epidemic algorithm requires a service returning a random sample of the nodes. Show a *distributed peer sampling protocol* for P2P systems. (8pt)

4) Assume we have an n-bit identifier space. Compare the following distance metrics for nodes $u, v \in V$ with identifiers $id(u)$ and $id(v)$: (6pt)

$$d_{\oplus}(u, v) := id(u) \oplus id(v)$$

$$d_{\wp}(u, v) := \min\{|id(v) - id(u)|, 2^n - |id(v) - id(u)|\}$$

$d(u, v)_{\oplus}$ is used by Kademlia and $d(u, v)_{\wp}$ is used by Pastry

- a) what is the maximal distance in both metrics?
- b) assuming a fixed node u, how many neighbours with distance 1 can u have in the different metrics?
- d) can you find an example where $d(u, v)_{\oplus} < d(u, v)_{\wp}$?

5) The definition of incentive mechanisms to promote peers' cooperation is an important issue in P2P systems. Describe the solutions proposed in eMule and Bittorrent. (8 pt)