

# Homework 1: P2P

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## 1 Quick questions

1. Napster servers, as discussed in lecture, do not store which of the following?
  - Meta information about files, e.g., artist, song name, etc.
  - Files
  - Addresses of other Napster servers
  - Addresses of some of the peers (clients)
2. Which of the following Gnutella messages are flooded out and TTL restricted?
  - OK
  - Pong
  - Query
  - Giv
3. In BitTorrent, a new leecher is downloading a file with 5 blocks (B1 through B5). The leecher has 3 neighbors X, Y, and Z. These neighbor peers have the following blocks: X: (B1, B2, B3, B4). Y: (B1, B3, B4, B5). Z: (B1, B3, B5). Which of the following blocks does the leecher prefer downloading first?
  - B2
  - B5
  - B3
  - B1

## 2 DHT

1. A Pastry DHT has a peer P with the following neighbors. P currently has to route a query to key 101011001111. Which of the following neighbors is the best next hop for this query?
  - Cannot tell because Ps node id is not given
  - 101001011000
  - 111111100000

- 101011001110

2. In a Pastry DHT that is locality aware, the path of a query is very likely to:
  - Take equal sized network jumps in its early hops and in its later hops
  - Take long network jumps in its early hops and short network jumps in later hops
  - None of the above.
  - Take short network jumps in its early hops and long network jumps in later hops.

### 3 Gnutella

1. A Gnutella topology looks like a balanced ternary tree with 5 levels of nodes, i.e., peers. Thus, there is 1 root at Level 1, which has 3 children at Level 2, which each have 3 children at Level 3, which in turn each have 3 children at Level 4, which in turn each have 3 children at Level 5 thus, there are a total of 121 nodes. If the root node (Level 1) sends a Query message with TTL=3, then what are the number of nodes receiving the Query message, not including the originating node?
2. A Gnutella topology looks like a balanced ternary tree with 4 levels of nodes, i.e., peers, as shown in the picture 1. Thus, there is 1 root at Level 1, which has 3 children at Level 2, which each have 3 children at Level 3, which in turn each have 3 children at Level 4 thus, there are a total of 40 nodes.

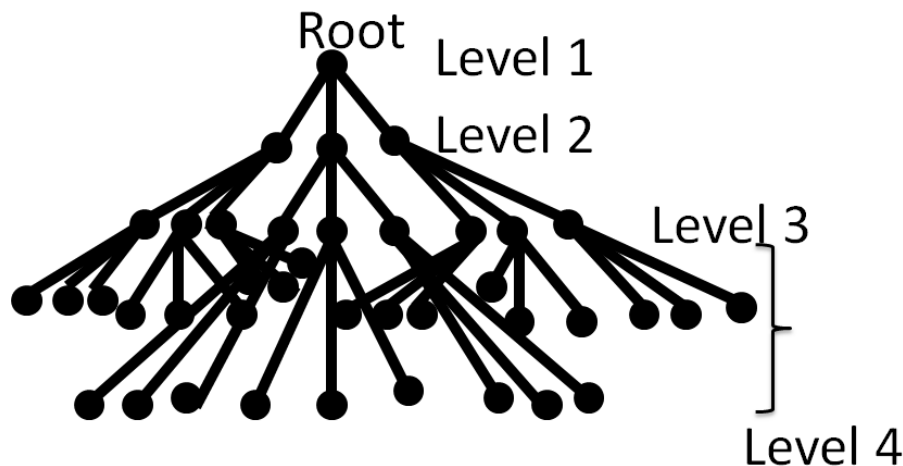


Figure 1: A Gnutella topology

If one of the leaf nodes (Level 4 nodes in the tree) sends a Query message with TTL=3, then what are the number of nodes receiving the Query message, not including the originating node?

3. A Gnutella topology looks like a balanced ternary tree with 4 levels of nodes, i.e., peers, as shown in the picture below. Thus, there is 1 root at Level 1, which has 3 children at Level 2, which each have 3 children at Level 3, which in turn each have 3 children at Level 4 thus, there are a total of 40 nodes.

If a child of the root (i.e., a Level 2 node in the tree) sends a Query message with TTL=3, then what are the number of nodes receiving the Query message, not including the originating node?

4. A Gnutella topology looks like a balanced ternary tree with 4 levels of nodes, i.e., peers, as shown in the picture below. Thus, there is one root at Level 1, which has 3 children at Level 2, which each have 3 children at Level 3, which in turn each have 3 children at Level 4 thus, there are a total of 40 nodes.

If the originating node of the Query is a leaf (Level 4 node), what is the minimum TTL to ensure all nodes in the system receive the Query?

## 4 Chord ring

1. In a Chord ring using  $m = 8$ , nodes with the following peer ids (or node ids) join the system: 45, 32, 132, 234, 99, 199. What node id is the file with id 120 stored at (assuming only one replica)?
2. In a Chord ring using  $m = 9$ , nodes with the following peer ids (or node ids) join the system: 1, 12, 123, 234, 345, 456, 501. Which of the following nodes is not present as a finger table entry or successor of 234?
3. In a Chord ring using  $m = 9$ , nodes with the following peer ids (or node ids) join the system: 1, 12, 123, 234, 345, 456, 501. Node 234 initiates a search (query) for key 10. What is the comma-separated list of all nodes traversed by this query, including the final destination (including both originating node and final node)?

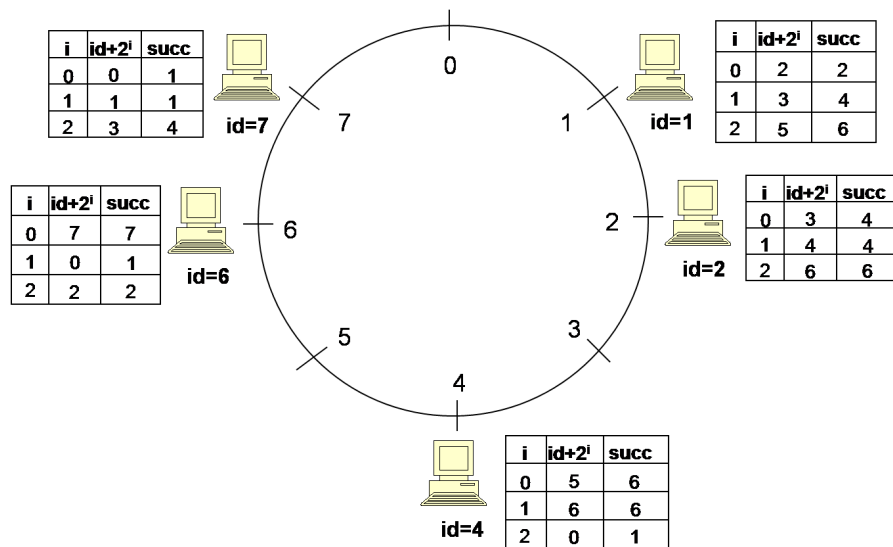
Use the text box below to enter your answer as a sequence of numeric values with each numeric value separated by a comma. Please ensure you enter the node ids in the order traversed, and include both starting and ending nodes in the sequence.

4. In a Chord ring using  $m = 9$ , nodes with the following peer ids (or node ids) join the system: 1, 12, 123, 234, 345, 456, 501. If node 234 fails, which of the following nodes will not update any of their finger table entries or successors: 456, 234, 1, or 12?
5. In a Chord ring using  $m = 8$ , nodes with the following peer ids (or node ids) join the system: 45, 32, 132, 234, 99, 199. If node 45 fails, then what is the comma-separated list of all the nodes whose finger tables need to be updated?

Use the text box below to enter your answer as a sequence of numeric values with each numeric value separated by a comma. Please ensure you list nodes in increasing order of id.

6. Teo set up a P2P network to share poor jokes with other mates, but hes worried that the RIAV will shut down his centralized server, just like NMPA did to Napster. So he set up a Chord ring for lookups and routing in his peer to peer network. Sadly, Teo's network is not popular, consisting of only four peers. The peers contain the

listed have successor tables as shown (the  $id + 2^i$  column is there to remind you how the successor table is set up).



- Now, jokes (items) are added to the DHT. Which node(s) would store the jokes with the following ids: 3, 5, 0, 2, 7, 1?
- List the nodes that will receive a query from *node 4* for *item 2*.
- List the nodes that will receive a query from *node 2* for *item 5*.
- Tun thinks that these jokes are awful, so he launches a DDoS attack and takes out *node 4*. Time passes, and the nodes converge on new routing tables that don't involve *node 4*. Later, *node 7* queries for Item 5. List the nodes that will receive this query.