

# 22C: 196: 001 Peer-to-peer Networks

## Spring 2008, Assignment 1

### 50 points

Assigned February 12, 2008, Due February 21, 2008, in class

*Please submit the answers in a typewritten form. Good documentation is essential. Your solution should reflect your own thoughts, not someone else's ideas. It is ok to consult other papers, but please cite them at the end of the answer. The \* marked question is more difficult (or perhaps more open ended) than the others. Answer as many questions as you can.*

Questions 1-3 are each worth 10 points, and Question 4 is worth 20 points.

1. The topology of a Gnutella network is a graph  $G=(V, E)$ , where  $V$  is the set of nodes and  $E$  is the set of edges. Each edge is a bidirectional link. For any object, there may be zero or more copies of it present at any subset of the nodes. Assume that a given object is present at 1% of the nodes. Also assume that the system uses random walkers to locate objects in the network. If you use **three** random walkers, and expect the success rate to be **90%**, then (1) what will be the minimum value of the TTL (the time after which the search will be abandoned)? What will be expected overhead (defined as the total number of hops made by all the walkers) for this search?

2. How does Tapestry tolerate network partition (caused by node or link outage) that can potentially disconnect (or bring down) the root of the desired object from the client of the query?? Explain your answer.

3. Consider a Chord network with  $N=2^{16}$  nodes, and a keyspace of the same size. What is the smallest routing distance from the node with key 0110 1001 1100 1010 to the node with key 0101 1001 1100 1111? How will this distance change if bidirectional routing is used (i.e each node maintains  $2 \cdot \log_2 N$  fingers instead of  $\log_2 N$  fingers)?

\*4. Is it possible to come up with a P2P network that combines the best features of both Gnutella (i.e. a typical unstructured network) with Chord (a structured network), so that you get the best of both worlds? Present such a scheme, and explain how it will work. What benefits and drawbacks will the new network have?