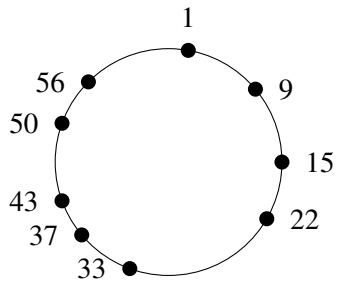
CS 237 Homework 2

Middleware, Spring 2022

Due: Monday May 2, 2022 at 11:59pm, via Gradescope

Problem 1: Chord

The figure below represents the 6-bit ID space and the mapping of 9 nodes with their node IDs. Suppose that each node uses the Chord DHT protocol and stores up to 5 entries in its finger table (i.e., $m = 5$).



1. Determine the finger tables for the following nodes.

(a) Node ID 50 Finger Table

Entry	Node
1	
2	
3	
4	
5	

(b) Node ID 22 Finger Table

Entry	Node
1	
2	
3	
4	
5	

2. Suppose that Node 15 gets a query for key 57. List the nodes to which the query is forwarded.

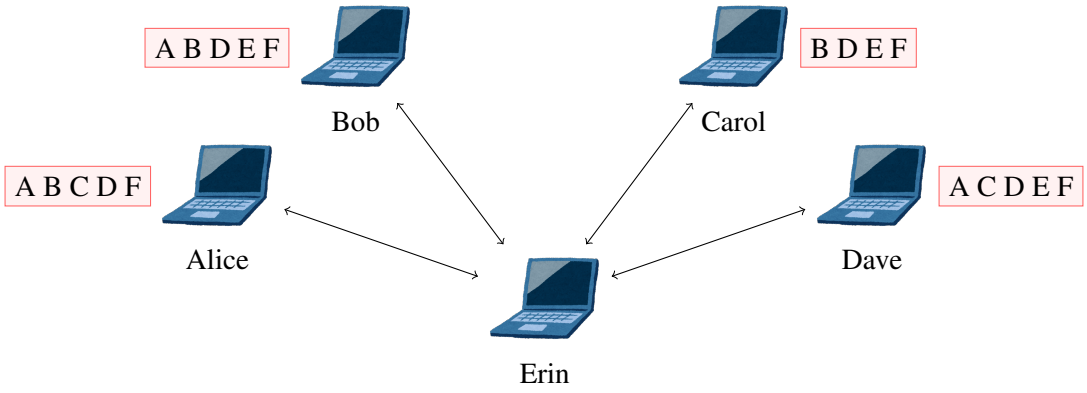
3. Suppose that a new Node with ID 24 wishes to join. List the *range* of keys that each node below would be responsible for. Express your answer as a tuple (low-key, high-key), e.g., (1,3).

Node ID	Interval Before	Interval After
22		
24	n/a	
33		

4. (Extra Credit) List the nodes that would need to change their finger tables after Node 24 joins.

Problem 2: BitTorrent

The diagram below shows 4 peers (Alice, Bob, Carol and Dave) who have chunks of a file X. Let file X consist of 6 chunks (A,B,C,D,E,F). The red box next to each name indicates which file chunks each peer has. Suppose that a new peer, Erin, enters the swarm and wishes to download file X.



1. Suppose that Erin first receives a chunk E. What is the next chunk that is sent to Erin? How is this decided?

2. After Erin receives the chunk from part (2), Carol sends a request to Erin for a chunk that it needs. However, Erin's machine does not respond to the request. What does Carol's machine do? In general, what mechanism does BitTorrent use to discourage peers from only downloading?

3. (Extra Credit) Suppose that Erin's machine was just incredibly slow at the time of Carol's request, but now has a fast upload speed. How would Carol be able to learn that Erin now has a fast upload speed? In general, what mechanism does BitTorrent use to allow peers to explore the network?

Problem 3: Paper Summaries

Summarize 2 papers selected from the topics given in the course timeline for Summary Set 2. They should be 1 to 1.5 pages of text (suggested size 10-11 pt, single spaced, 1-inch margins). Your summaries should provide the following information about the paper in your own words:

1. The main contributions of the paper: the key problem(s), proposed techniques and approaches
2. The critiques of the approach: its advantages and its limitations
3. The implications to technology practice, i.e., implementation feasibility in a distributed computing environment