Homework 1

Due: 11:59 PM, Feb 20, 2019

Contents

1 Consistent Hashing

a. Explain the difference between consistent hashing and modulo hashing, for assigning objects to a server.

b. When changing the number of servers, the number of objects that have to be reassigned is different between the two schemes. For both a modulo hashing and a consistent hashing setup with N servers ($\mathbf{N = 1024}$) with a perfectly uniform hash function, what fraction of the objects have to be reassigned when N changes by 1 (a server removed or added). Explain your reasoning.

c. A nice property of consistent hashing is that it is easy to accommodate servers with more capacity. Say, for example, that a server has twice the amount of space than the others. How can we make this server receive twice as many objects than the others, if we are using consistent hashing?

2 Chord

a. Consider a Chord DHT with an ID space between 0-127. There are 13 nodes in the DHT: 1, 8, 12, 15, 20, 21, 34, 50, 67, 81, 100, 111, 127. On which of these nodes are the objects with the following ids located?

   (a) 20
   (b) 101
   (c) 127
   (d) 0
   (e) 53
   (f) 67

b. What is the finger table for node 1 (assume the finger table has 5 entries)?

	Node Id
1	
2	
3	
4	
5	

c. Given a finger table of size 5. If a client starts a lookup at node 50 for id 4, how many nodes will it consult (including node 50, and the node it ends up at)?

d. What order are the nodes consulted in the above lookup? List them in the order they are consulted.

e. What is the ideal or optimal size for the finger table if the id space of a DHT is between 0-1023? Why?

3 Tapestry

a. Given a Tapestry network with the following nodes (the base is 4): 3010 2211 3212 0131 2102 0033 1232, what is the root for the following objects?

- 0123
- 2321
- 3212
- 0012
- 0321
- 2121

b. Write down a possible neighbor table for node 2000 (if there are multiple possibilities for an entry, you can choose arbitrarily).

c. What is the definition of a need-to-know node? What are need-to-know nodes for node 2000?

4 Handing In

Once finished, you should hand in a PDF with your answers on Gradescope. Gradescope will allow you to select which pages contain your answers for each part of each question.

Please do not put your name on any page of your handin! This will allow us to do fully anonymized grading through Gradescope.

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