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## Homework 1: Writing Component

### Routing Packets Within a Structured Peer-to-Peer (P2P) Network Overlay

VERSION 1.0

DUE DATE: Friday, February 21<sup>th</sup>, 2020 @ 5:00 pm

Please answer the questions below briefly.

**Nota Bene:**

Discussions about the written assignment on Piazza or Canvas is expressly disallowed. The person who posts the question and the person answering the question will BOTH get a ZERO. No exceptions will be made.

**Q1.** What was the biggest challenge that you encountered in this assignment?

Note: The challenges should relate to design decisions and algorithmic choices and not so much to do with unfamiliarity with programming elements such as sockets, etc.

[300-350 words]

**Q2.** If you had an opportunity to redesign your implementation to ensure that you have exactly two synchronized blocks in your entire codebase, how would you go about doing this?

[300-350 words]

**For Q3, Q4, and Q5:**

One of the areas where DHTs (Distributed Hashtables) are particularly useful is for serving content in a scalable fashion. Here the file (its name or content) is hashed, and stored on the node with the closest ID in the *clockwise* direction. If the hash value for a file is  $h$  it will be stored on a node with the smallest  $ID \geq h$  in the clockwise direction.

Consider the case where you are building a music streaming service that will need to support a large number of users. The simplified DHT that you have built provides the base for this service. Clients will connect to any one of the nodes in your DHT and try to discover content. The DHT nodes will use the routing table to route client "search" requests to the appropriate node; the "responsible" node will then confirm whether such content exists or not. Once the DHT node (or server) holding the necessary content is discovered, the client will stream music from that server.

You have a small portfolio of bands whose music you plan to stream: Arcade Fire, Beatles, Coldplay, Bob Dylan, Grateful Dead, Jethro Tull, Led Zeppelin, Phish, Rolling Stones, Radiohead, Springsteen, Talking Heads, and U2. Some bands are more prolific than others, some bands are more popular than others, and some albums/songs are more popular than others.

**Q3.** How do you ensure that the streaming load for songs is dispersed over the DHT? Specifically, you wish to avoid situations where some of your nodes are actively serving content while some are idling away.

[300-400 words]

**Q4.** Your streaming music service is slowly getting popular and you have procured a machine that is 16 times as powerful as the other (identical and homogeneous) machines in your DHT. How would you account for this new powerful node while ensuring that it is not underutilized?  
[300-400 words]

**Q5.** How would you cope with the corner case where a song is 3 times more popular than the average song?  
[300-400 words]

## 1 Grading

Homework 1 accounts for 15 points towards your final course grade. This written component accounts for 20% of the points set aside for HW1 i.e. this assignment accounts for 3% of your cumulative course grade. This assignment is graded on a 15 point scale with each question accounting for 3 points.

## 2 What to Submit

You should submit a PDF document. Please use the following naming convention: HW1-WC-Firstname-Lastname.pdf.

The folder set aside for this assignment's submission using checkin is **HW1-WC**