# Computer Networks Lab

## Assignment 7

### Problem Statement

This assignment is a natural extension of the sixth assignment. Here are the subtasks that need to be done:

1. Construct a finger table at each node and optimize routing.

   The basic approach is to pass the query to a node's successor, if it can not find the key locally. This will lead to a O(N) query time.

   To avoid the linear search above, Chord implements a faster search method by requiring each node to keep a *finger table* containing up to $m$ entries. The $i^{th}$ entry of node $n$ will contain $successor\left((n + 2^{i-1}) \bmod 2^m\right)$. The first entry of finger table is actually the node's immediate successor (and therefore an extra successor field is not needed). Every time a node wants to look up a key $k$, it will pass the query to the closest successor of $k$ in its finger table (the "largest" one on the circle whose ID is smaller than $k$), until a node finds out the key is stored in its immediate successor.

   Note: [0, $2^m$ - 1] is the range of the hash function 'h' used in the previous assignment.

2. Adding a new node (say, with node_id 'k')

   Whenever a new node joins, three invariants should be kept:
   - Each node's successor points to its immediate successor correctly.
   - Each file (with file_id) is stored in the node (with node_id )
     where node_id >= file_id and node_id is the minimum such id that can be assigned to an existing node.
   - Each node's finger table should be correct.

   It can be achieved by migrating relevant files from k's successor to Node(k), migrating the files shared by Node(k) to their appropriate nodes with respect to the file_ids assigned to each file, initializing the finger table for the new Node(k) and modifying the finger tables of each node to ensure correctness of the routing algorithm.

3. Deleting an existing node

This can be achieved by transferring the files shared by the node to be deleted to its successor and modifying the finger tables of the concerned nodes to expunge any references to the deleted node.

Also, cite the run time of the three tasks mentioned above based on your approach.

## References:

- Chord: A scalable peer-to-peer lookup service for internet applications