

**Oppgave 20.7.1:** Given the circle of nodes of Fig. 20.14, where do key-value pairs reside if the key hashes to:

- (a) 35 (b) 20 (c) 60?

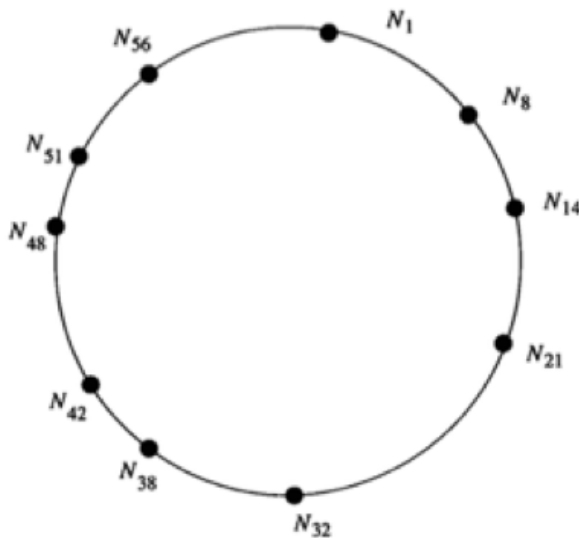


Figure 20.14: A chord circle

To place a node in the circle, we hash its ID  $i$ , and place it at position  $h(i)$ . We shall henceforth refer to this node as  $N_{h(i)}$ . Thus, for example, in Fig. 20.14,  $N_{21}$  is a node whose ID  $i$  has  $h(i) = 21$ . The successor of each node is the next higher one clockwise around the circle. For example, the successor of  $N_{21}$  is  $N_{32}$ , and  $N_1$  is the successor of  $N_{56}$ . Likewise,  $N_{21}$  is the predecessor of  $N_{32}$ , and  $N_{56}$  is the predecessor of  $N_1$ . The nodes are located around the circle using a hash function  $h$  that is capable of mapping both keys and node ID's (e.g., IP-addresses) to  $m$ -bit numbers, for some  $m$ . In Fig. 20.14, we suppose that  $m = 6$ , so there are 64 different possible locations for nodes around the circle. In a real application,  $m$  would be much larger. Key-value pairs are also distributed around the circle using the hash function  $h$ . If  $(K, V)$  is a key-value pair, then we compute  $h(K)$  and place  $(K, V)$  at the lowest numbered node  $N_j$  such that  $h(K) \leq j$ . As a special case, if  $h(K)$  is above the highest-numbered node, then it is assigned to the lowest-numbered node. That is, key  $K$  goes to the first node at or clockwise of the position  $h(K)$  in the circle.

**Oppgave 20.7.2:** Given the circle of nodes of Fig. 20.14, construct the finger tables for:

- (a)  $N_{14}$  (b)  $N_{51}$

**Oppgave 20.7.3:** Given the circle of nodes of Fig. 20.14, what is the sequence of messages sent if:

- a)  $N_{14}$  searches for a key that hashes to 27?
- b)  $N_8$  searches for a key that hashes to 5?
- c)  $N_{56}$  searches for a key that hashes to 54?

**Eksamen 2013.**