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Effiziente Algorithmen und Datenstrukturen I

Aufgabe 1

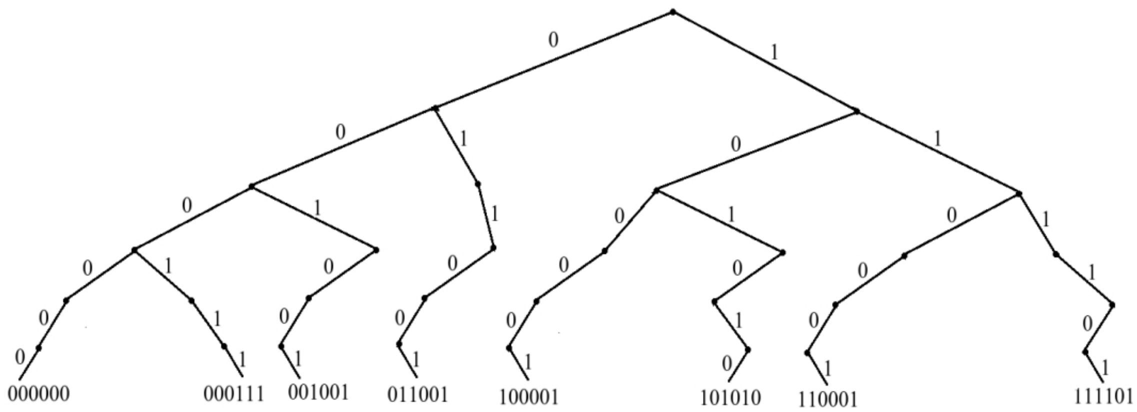
Consider Cuckoo Hashing. Assume we have two tables, T_1 and T_2, of size 10 labeled from $0-9$ and each table has a hash function associatd with it, h_1 and h_2, respectively. Using the following hash values to perform the given operations and show T_1 and T_2 after each step:

$$h_1(a) = 5, h_2(a) = 7 \qquad h_1(b) = 7, h_2(b) = 3 \qquad h_1(c) = 5, h_2(c) = 3$$
$$h_1(d) = 7, h_2(d) = 1 \qquad h_1(e) = 5, h_2(e) = 0$$

1. insert(a)
2. insert(b)
3. insert(c)
4. insert(d)
5. insert(e)
6. delete(b)
7. delete(d)

Aufgabe 2

Consider the following Trie:



Carry out the following operations and show the Trie after each operation.

1. insert(100011)

2. insert(111111)
3. delete (100001)
4. delete (000111)

Aufgabe 3

Consider the original Trie from Aufgabe 2 and construct the corresponding Patricia Trie.

Aufgabe 4

Consider the Patricia Trie from Aufgabe 3 and carry out the following operations and show the Patricia Trie after each operation.

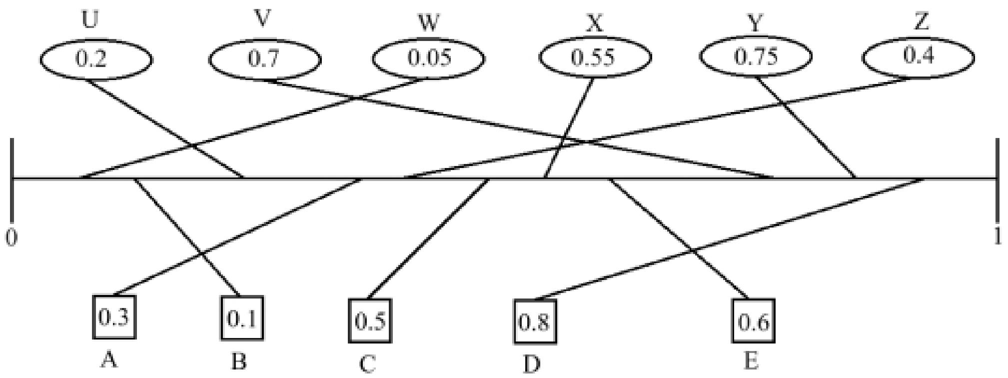
1. insert(111000)
2. insert(111001)
3. delete (000000)
4. delete (100001)

Aufgabe 5

Consider the Patricia Trie from Aufgabe 3, calculate all the MSD nodes, and show this tree with the MSD nodes.

Aufgabe 6

Consider the following Consistant Hashing layout:



The boxes (labeled A-E) represent Servers and the ovals (labeled U-Z) represent Data Items. Additionally, the hash values for each Server/Data Item is contained within the box/oval. For the following exercises, perform each operation on the result of the previous operation.

1. Describe which data elements are stored on which servers.
2. Describe which data elements are stored on which servers after a $leave(C)$ operation.
3. Describe which data elements are stored on which servers after a $join(F)$ operation. $(h(F) = 0.9)$