Assignment 1

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Download all Codes from

https://github.com/csrs2000/EE4013/blob/main/Assignment−1/codes

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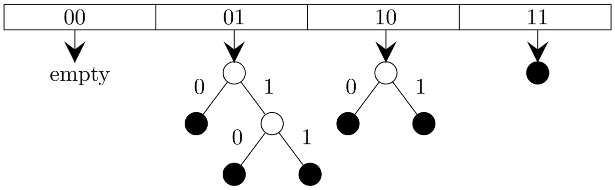
https://github.com/csrs2000/EE4013/blob/main/Assignment−1/Assignment1.tex

1 Problem

Consider a dynamic hashing approach for 4-bit integer keys:
1)There is a main hash table of size 4.
2)The 2 least significant bits of a key is used to index into the main hash table.
3)Initially, the main hash table entries are empty.
4)Thereafter, when more keys are hashed into it, to resolve collisions, the set of all keys corresponding to a main hash table entry is organized as a binary tree that grows on demand.
5)First, the 3rd least significant bit is used to divide the keys into left and right subtrees.
6)To resolve more collisions, each node of the binary tree is further sub-divided into left and right subtrees based on the 4th least significant bit.
7)A split is done only if it is needed, i.e., only when there is a collision.
Consider the following state of the hash table.



Which of the following sequences of key insertions can cause the above state of the hash table (assume the keys are in decimal notation)?
(A) 5,9,4,13,10,7
(B) 9,5,10,6,7,1
(C) 10,9,6,7,5,13
(D) 9,5,13,6,10,14

2 Solution

Answer:Option-(C)
Explanation
By using above rules we get below insights-
$\implies$ Sequence given in option (A) is not possible, because of entry 4 (= 0100) whose 2 LSB are 00 but the 00 column is empty.
$\implies$ Sequence given in option (B) is not possible, because of entry 1 (=0001) and 9 (=1001) These have 3rd LSB collision but in the given table theres no collision in the 3rd LSB of 01 column.
$\implies$ for Sequence given in option (C) there is no key with 00 indexing,5 (=0101),13 (=1101) have 3rd LSB collision ,9 (=1001) has no collision over 3rd LSB so these 3 form 2nd column elements,6 (=0110),10 (=1010) form the elements of 3rd column,7 (=0111) forms element of the last column
$\therefore$ hence this is the correct option
$\implies$ Sequence given in option (D) is not possible, because of entry 6 (=0110), 10 (=1010), and 14 (=1110) in the third column,but the third column only has 2 entries.
Below C-Program implements the above described dynamic 4 bit hashing table

https://github.com/csrs2000/EE4013/blob/main/Assignment−1/codes/hashtable.c