Mahidol University
International College

ICCS315 Applied Algorithms

Assignment 1 Report

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Contents

Chapter 1

Resizeable Arrays

Traditionally, resizable array has a high amortized cost depending on α for expansion and shrinking. HAT array theoretically fares with a constant amortized cost on expansion and shrinking. Our goal is to perform teh benchmarking of the actual implementation of traditionaly resizable array and Sitarski's HAT array.

1.1 Set up

Both of data structure implementations are written in C++ which runs on ubuntu server. The actual implement is in Github.

1.2 Append latency

In this section, the cost of appending one key to the array mainly comes from reading memory. On tradditional resizable array, pushing new key to the back costs approximatetly 47 cycles from reading memory pointer which needs to be conducted at most the entire array. On the other hand, Sitarski's HAT array takes less cycle per apeend operation since the entire array is separated into b size where b where $b = 2^k$.

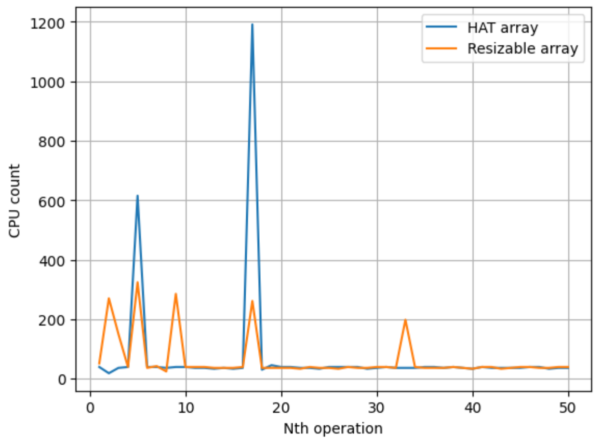


Figure 1.1: Benchmark of each append costs

Figure 1.1 shows the cost of each append out of 50 append operations. Tradditional resizable array shows up to stike CPU cycle more on each operation since the expansion happens more often than HAT array. However, HAT array costs significantly higher cycle because the resizing needs to be done in both levels combine with copying data over.

In conclusion, traditional resizable array takes more cycle to access memory and append new day than HAT array. On the expansion, tradditional resizable array is better than HAT array.

Chapter 2

Space usage of skip lists

Chapter 3

Skip lists

Chapter 4

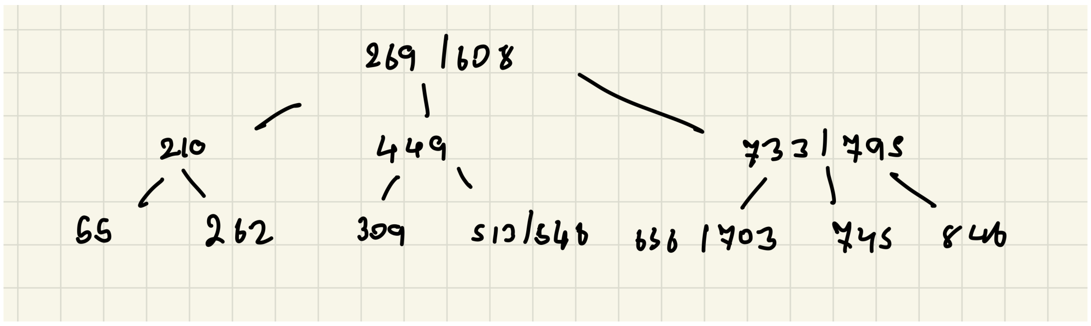
(a,b) tree

4.1 Multiple keys insertion.

Starting with an empty tree, we want to insert the following keys:

733, 703, 608, 846, 309, 269, 55, 745, 548, 449, 513, 210, 795, 656, 262

The result of *(2,3) tree* is



4.2 Key deletion

Suppose that we want to delete 309 in *(2,3) tree*, it falls into case 1 which we need to steal from sibling.

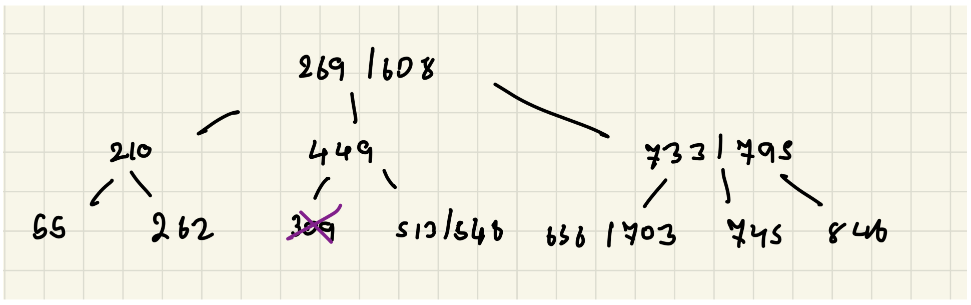


Figure 4.1: Unbalanced tree without key 309

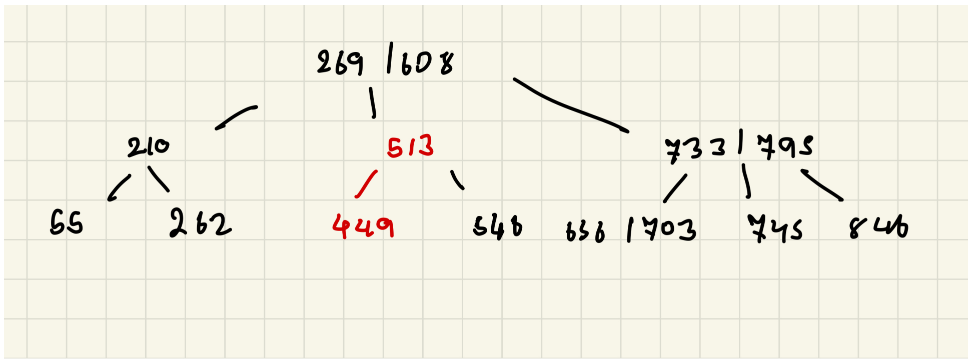


Figure 4.2: Balanced tree after finding replacement by stealing

As you can see in Figure 4.2, the replacements are 513 and 449 which 513 is the new parent node that has 449 and 548 as a child nodes.

$$\alpha_{\text{me}} = a - 1 + 1$$

Chapter 5

B-tree speed