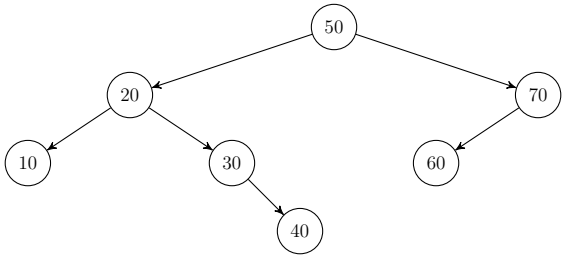
King Saud University
Department of Computer Science
CSC 212 Homework # 6

Fall 2017

Guidelines:	This is an individual assignment. The homework must be **submitted electronically through LMS**. **Submissions by email and hard copy submissions are not accepted**.

Problem 1

Perform the following operations on the AVL tree below: **Insert 55**, **Insert 35**, **Insert 65**, **Insert 45**, **Delete 10**, **Delete 30**, **Delete 50**. Mention the rotation type: none, single, or double. Each operation is independent, and must be performed on the original tree.



Problem 2

Complete the table below by computing the resulting balance for each of the specified rotations made on the trees shown in Figure 1.

Case	Initial balance	Rotation	Resulting balance
(a)	Bal_0(A)=-2, Bal_0(B)=-1	R(A)	Bal_1(A)=0, Bal_1(B)=0
(a)	Bal_0(A)=-2, Bal_0(B)=0	R(A)	Bal_1(A)=?, Bal_1(B)=?
(b)	Bal_0(A)=2, Bal_0(B)=1	L(A)	Bal_1(A)=?, Bal_1(B)=?
(c)	Bal_0(A)=-2, Bal_0(B)=1, Bal_0(c)=-1	L(B), R(A)	Bal_1(A)=?, Bal_1(B)=?, Bal_1(C)=?
(d)	Bal_0(A)=2, Bal_0(B)=-1, Bal_0(c)=0	R(B), L(A)	Bal_1(A)=?, Bal_1(B)=?, Bal_1(C)=?

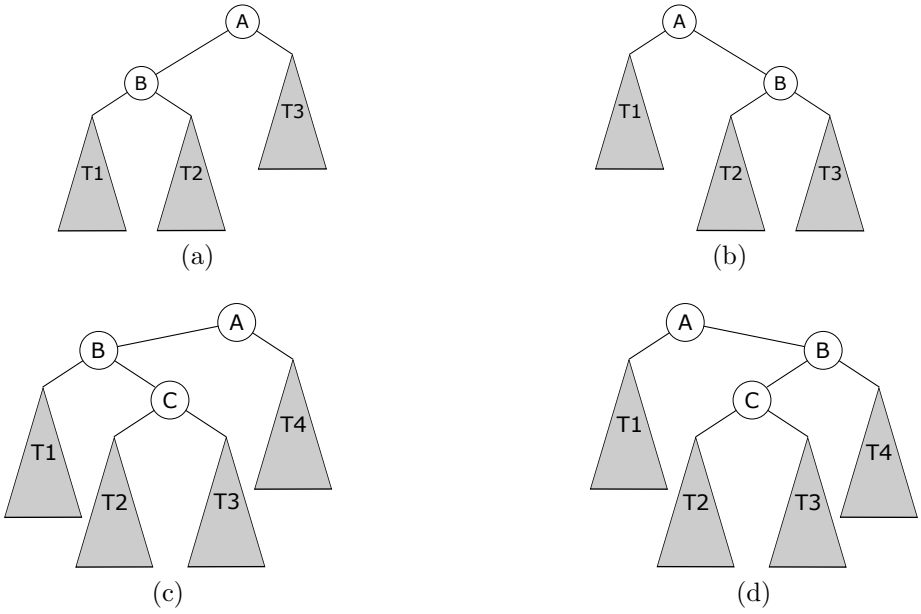
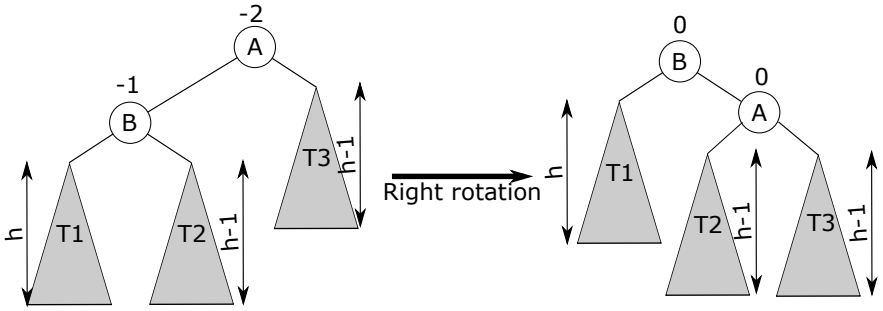


Figure 1: Trees.

Example 2.1. *For the first line:*



Problem 3

Given the B+ Tree of order 3 in Figure 2, do the following operations, **each on the original tree**, and draw the tree at each step: Insert 30, Insert 48, Insert 20, Delete 11, Delete 25, Delete 19.

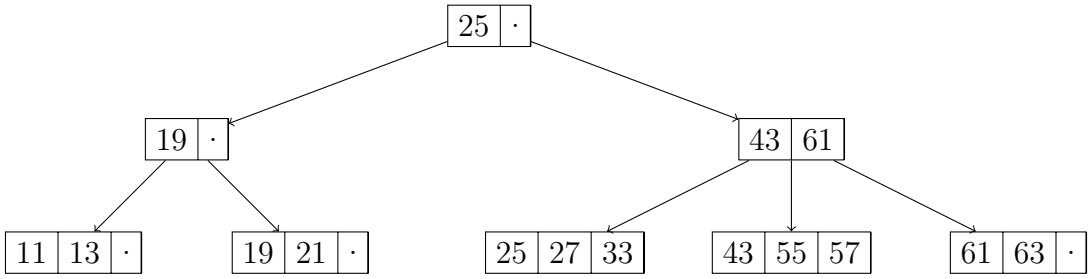


Figure 2: B+ Tree.

Problem 4

We want to store the following sequence of keys in a hash table: 407, 801, 815, 704, 814, 721, 935. Draw the result of inserting these keys for each of the following tables:

1. Hash function: Select the last two digits then use division by 7: $h(k) = (k\%100)\%7$. Collision resolution strategy: Linear rehashing with $c = 2$ (Show the number of probes).

2. Hash function: Folding on a single digit then use division by 7. Collision resolution strategy: External chaining.

3. Hash function: $h(k) = (3\times(k\%100))\%7$. Collision resolution strategy: coalesced chaining with a cellar size of 2 (Show clearly the links and the final location of epla).

Problem 5

Given the following hash table of size 9 to store integer keys:

- Hash function: $h(k) = k\%9$.
- Collision resolution strategy: Linear probing with $c = 1$.

If we insert the following keys in the order 1, 6, 11, 14, 3, 12, 5, 28, 9, what is the aggregate (overall) number of collisions? (i.e how many times will an element try to move to location that is already occupied?)

Problem 6

1. Draw the max-heap (tree form) that results upon inserting the following keys: 4, 12, 16, 21, 45, 33, 10 and 60. The heap is initially empty.

2. Draw the previous heap after removing two elements.

3. Apply heap sort to sort the following array in increasing order:

(a) If you want to sort the array in-place (without using an additional array) what type of heap will you use?

(b) Draw the resulting array after converting it into a heap.

(c) Draw the array after removing each element (the array must be sorted in-place, so show the complete content of the array at every step).

0	1	2	3	4	5	6
-	12	20	18	23	28	15

Problem 7

Consider the undirected graph shown in its adjacency matrix representation below.

-	a	b	c	d	e	f	g
a	0	1	1	1	0	0	0
b	1	0	0	0	1	0	0
c	1	0	0	0	0	1	0
d	1	0	0	0	1	1	0
e	0	1	0	1	0	1	1
f	0	0	1	1	1	0	1
g	0	0	0	0	1	1	0

1. Draw this graph.
2. Give its adjacency list representation.
3. Give its BFS and DFS traversals starting at node a (order the children in alphabetical order).