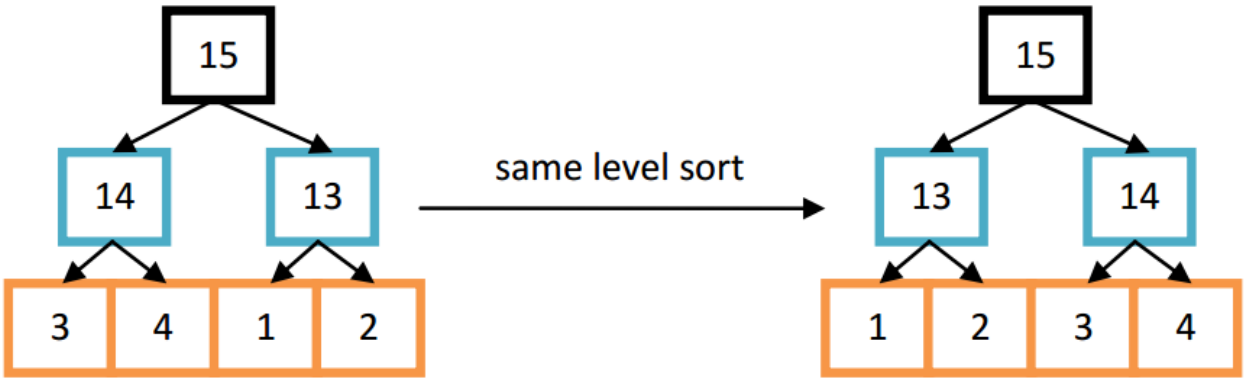
# Tutorial 7 – Heap & Hash

## Problem 1

For each height level of a heap, you sort them in ascending order. For example:




Does the above operation (same level sorting) always preserve the mandatory properties of a max heap? Why?

## Problem 2

State the big-O of the following operations:

a) Find max of a max heap.
b) Delete heap.
c) Insert a new node.

## Problem 3

Delete an arbitrary node: The provided deleteHeap function is only able to delete the root of a heap. Write another function that allows you to delete any node in a heap:

```
bool DeleteHeapNode(int *&maxHeap, int delPosition, int &size, int & dataOut)
```

## Problem 4

Given the following hash and probing function:

$$h(key) = key \,\%\, 256 + 1$$

$$hp(key) = key$$

**a. Collisions:**

You have a list L1 of 1024 keys ranged from 1 to 1024. If you start hashing them one by one using the above functions, how many collisions will occur?

**b. More collisions:**

Now, instead of the above probing function, you use the following linear probing function to resolve the collisions:

$$hp(key) = (h(key) + i) \% 512$$

How many probing you need to do if you have to hash the list L2 = {0, 256, 512, 513, 1026, 1025}? Draw the hash table after you insert 512, 1025.