CS 340 Homework 1

“Due Monday September 21”
Skip List

- Extension of the ideas of a sorted list
- Allows searching in $O(\log_2)$
Perfect Skip List

The number of next references in each node is \( \text{floor}(\log_2)+1 \)
Perfect Skip List Search

• Start at top list and repeat the following until the search value is found or not found

• If at bottom list and there is no next item or at bottom list and search value < item in next node then not found

• If search value == item in next node then found

• If search value < item in next node or there is no next node then move down one list

• If search value > item in next node move to next node
Perfect Skip List
Search for 30

-∞ → 10 → 20 → 30 → 40 → 50 → 60
Perfect Skip List
Search for 30
Perfect Skip List
Search for 30
Perfect Skip List
Search for 60
Perfect Skip List
Search for 60
Perfect Skip List
Search for 35
Perfect Skip List
Search for 35
Perfect Skip List
Search for 35
Perfect Skip List
Printing

40
20, 40, 60
10, 20, 30, 40, 50, 60
Homework 1

- Implement the perfect skip list class shown on the following slides. You must write a test driver to test your implementation. Your implementation of the perfect skip list must not depend on your test driver because I will use my own test driver to test your program.
import java.util.*;

public class PerfectSkipList {
    private class Node {
        int key;
        Node next[];

        private Node( int k, int size) {
            key = k;
            next = new Node[size];  //Items are initialized to null by Java
        }
    }

    private Node head;
    private int height;
}
public PerfectSkipList(int keys[], int numKeys) {
    //PRE: keys is sorted in ascending order and numKeys <= keys.length
    //Create the skip list from the values in keys[0] through keys[numKeys-1]
}

public boolean find(int k) {
    //if k is in the list return true otherwise return false
    //Your implementation must make use of the structure of
    //the skip list

}

public void printList() {
    //print each list starting with the top list
    //print one list per line with the items separated by commas

}
private int log2(int bits) {
    //PRE: bits >= 0
    //Implementation taken from StackOverflow
    //https://stackoverflow.com/questions/3305059/
    //how-do-you-calculate-log-base-2-in-java-for-integers
    //returns floor(log(bits))
    int log = 0;
    if( ( bits & 0xffff0000 ) != 0 ) { bits >>>= 16; log = 16; }
    if( bits >= 256 ) { bits >>>= 8; log += 8; }
    if( bits >= 16 ) { bits >>>= 4; log += 4; }
    if( bits >= 4 ) { bits >>>= 2; log += 2; }
    return log + ( bits >>> 1 );
}
Homework 1 Submission

- At the top of the file include a comment that lists your name.

- Add a comment for each private method or private instance variable you add.

- Upload one zip file called h1YOURNAME.zip to Canvas. The zip file should contain only one file called PerfectSkipList.java. Do not include your test driver. The file must contain your implementation of PerfectSkipList. If you use System.out.println to debug your program those lines should be put in a comment (or removed). Your debug output should not print when I test your program.