UNIVERSITEIT VAN PRETORIA
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Department of Computer Science

COS212: Practical 1

Deadline: Friday 4 March 2022, 11:59

Objectives

The aim of this practical is to learn how to implement and use skip lists.

Instructions

Complete the task below. Certain classes have been provided for you in the *files* zip archive of the practical. You have also been given a main file which will test some code functionality, but it is by no means intended to provide extensive test coverage. You are encouraged to edit this file and test your code more thoroughly. Remember to test boundary cases. Upload **only** the given source files with your changes in a zip archive before the deadline. Please comment your name **and** student number in at the top of each file.

Task 1: Skip Lists [30]

A skip list is a variant of the ordered linked list that makes a non-sequential search possible. This data structure was proposed by William Pugh in his paper "*Skip Lists: A Probabilistic Alternative to Balanced Trees*". It allows *O(log n)* search complexity as well as *O(log n)* insertion and deletion complexity within an ordered sequence of `n` elements. This is achieved by building a linked list with multiple layers or levels. The bottom level is an ordinary linked list, while each higher level is a sparser subset list of the level below it.

You have been given a partially implemented skip list class and a skip list node class to use. Your task is to implement the following methods in the skip list class according to the given specification:

```
boolean isEmpty()
```

This function should determine whether the skip list is empty or not. It returns true if the skip list is empty and false otherwise.

```
void insert(T key)
```

This function should insert the given `key` in the skip list. `key` should be inserted in the correct position in the skip list to maintain the increasing order. `key` should also be added to all the levels as determined by the `chooseLevel()` method.

```
T first()
```

This function should determine the first key in the skip list. It returns the first key value in the skip list.

```
T last()
```

This function should determine the last key in the skip list. It returns the last key value in the skip list.

`T search(T key)`

This function should find the given `key` in the skip list. If `key` is found in the skip list it should return the key value and otherwise it should return `null`.

Only implement the methods listed above. Do not modify any of the other code that you were given for this task.

Submission

You need to submit your source files on the Assignment website `https://ff.cs.up.ac.za/`. All tasks need to be implemented (or at least stubbed) before submission. Place **SkipList.java** and **SkipListNode.java** file in a zip or tar/gzip archive (you need to compress your tar archive) named uXXXXXXXX.zip or uXXXXXXXX.tar.gz where XXXXXXXX is your student number. You have 4 days to complete this practical, regardless of which practical session you attend. Upload your archive to the *Practical 1* slot on the Assignment website. Submit your work before the deadline. No late submissions will be accepted.