CMPT 225 D2
Fall 2020
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Assignment 5
Skip Lists

Due Nov 20 at 23:59

You are to write a skip list class, any associated exception classes, and do some tests of it. As part of the code, you will need to be able to print a skip list.

The entry class should be called **Entry**, and it should hold a key (integer) and data (a string). It should have a method called **random**(), which gives it a random key between 0 and 99, inclusive, and a random data string of three lowercase letters. It should have getters for the key and the data. It should have a toString method which converts it to a string like so: (14, drn). You may use your code from Assignment 4 for this class.

The principal class will be called **SkipList,** and it should hold Entry objects. It should have operations:

type	name	
Entry&	find(k)	// if the map M has an entry with key k, return it; // else, return a reference to a special Entry **end.**
Entry&	greaterEntry(k)	// finds the entry with the lowest key that is greater than k.
Entry&	lessEntry(k)	// finds the entry with the greatest key that is less than k.
void	put(k, v)	// if there is no entry with key k, insert entry (k, v), // and otherwise set the entry's value to v.
void	erase(k)	// if the map M has an entry with key k, remove it from M. // Otherwise give an error.
int	size()	// number of elements in the skip list
bool	empty()	// is size == 0

It should also have a constructor and a destructor. You will need a **QuadNode** class that holds the four pointers and a reference/pointer to an Entry.

Note that the functions are given approximately. Add or remove references (&) where necessary or sensible, and add **const** to arguments and functions if they are const. I also haven't defined all the data members that the classes should have.

Your code should also include a "print" function for SkipList. It can be an overloaded operator<< if you like, or a simple function. It should print each list of the skip list, with the smallest list first, in the fashion that skip lists were shown in lecture. Each element should print only the key and should be allocated 2 spaces; each connection between elements should be two dashes (minus signs). A simple example is the following, for a skip list of 4 lists containing 14, 18, 27, 29, and 34:

```
-inf----------------------inf

-inf------18----------34--inf

-inf------18--27------34--inf

-inf--14--18--27--29--34--inf
```

In your main file, insert 8 entries into a skip list, then print the skip list. Delete an entry from the skip list, and print it again. Do one find of an element in the list, printing the result, and one find of an element not in the list (the one you deleted is best), printing the result. Next do a greaterEntry() and a lessEntry(), again printing the results.

Finally, generate 40 random entries and insert them all into an empty skip list. Print the skip list.

You will be judged on correctness of your code and on code style, so don't forget to keep your code clean as you develop it! (Or at the very least, clean it up before submission. We don't want to see untidy code.)