

Week 9 - Assignment (2 marks)

Note: All programs must use the appropriate C++ features.

Objective:

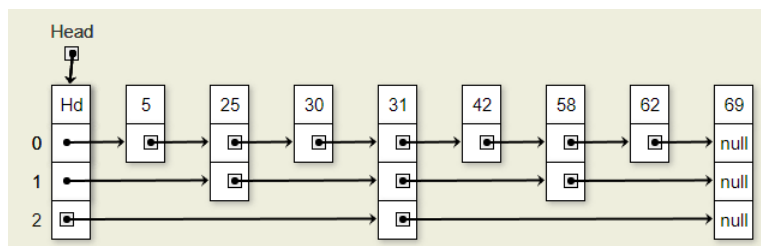
The task is to refactor an existing C++ implementation of a Skip List data structure, which is discussed in the lecture. The supplied code uses raw pointers and is not generic. You need to convert this code to use smart pointers and template classes to support any data type, enhancing safety and flexibility.

Tasks:

- 1) Implement Templating: Convert the Skip List and Node classes to template classes to allow for generic data types.
- 2) Memory Management: Replace all raw pointers in the code with appropriate smart pointers.
- 3) Code Integration: Integrate your program's core functionalities ensuring they align with the provided main function. This setup should demonstrate your program's capabilities effectively.
- 4) Expected Output: Utilize the supplied main function to validate that your program generates the expected output accurately. This step is crucial for verifying the correct implementation of functionalities such as insertion, deletion, search, and display within your Skip List.

Input:

Utilize the supplied main function to validate that your program generates the expected output accurately. **Must not change the main function.** The skip list used in the main function comes from the lecture, like below:



Output

The output should be like below:

```
===== Insertion =====
Successfully inserted key 5
Successfully inserted key 25
Successfully inserted key 30
Successfully inserted key 31
Successfully inserted key 42
Successfully inserted key 58
Successfully inserted key 62
Successfully inserted key 69

*****Skip List*****
Level 0: 5 25 30 31 42 58 62 69
Level 1: 25 31 58 69
Level 2: 31 69
```

```
===== Search =====
(level:2,node:-2147483648) ->
(level:1,node:-2147483648) ->
(level:1,node:25) ->
(level:0,node:25) ->
(level:0,node:30) ->
(level:0,node:31)
Found 31
```

```
===== Deletion =====
Successfully deleted key 31
key 31 destroyed.
```

```
*****Skip List*****
Level 0: 5 25 30 42 58 62 69
Level 1: 25 58 69
Level 2: 69
```

```
===== Automatic Memory Management =====
skip list destroyed.
key -2147483648 destroyed.
key 5 destroyed.
key 25 destroyed.
key 30 destroyed.
key 42 destroyed.
key 58 destroyed.
key 62 destroyed.
key 69 destroyed.
```

Submit:

1, **all C++ source code:** *.cpp and *.hpp if your code is organized into separate files.

Organizing the source code into separate files is not mandatory.

You can consolidate all code into a single cpp file.

2, **week9.txt:** a txt file contains all the source code.

3, **output.jpg**, or output.png, or output.bmp: a screenshot of the output by your program

Please refer to the submission page for the Marking Rubric.