

Map, Jumble, and Singly-Linked List with Dummy

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CSC220 Programming II – Spring 2016



Map



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 - ▶ It will have a null key and value.



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- ▶ The beginning of an implementation is [here](#).



This week's application



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- ▶ We need a nice application for our Map.



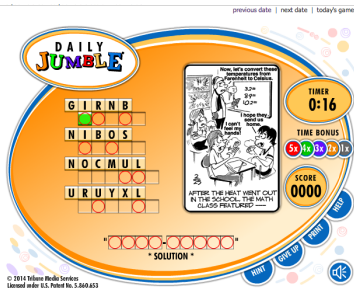
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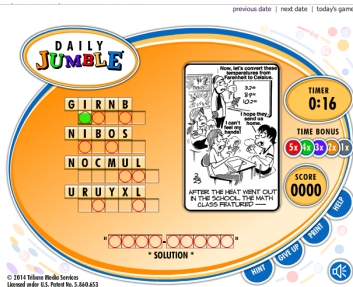
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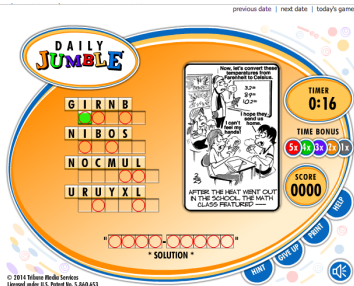
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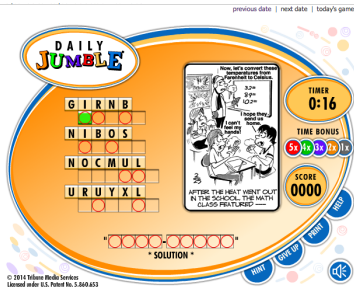
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 - ▶ Puzzle has “rtpocmue”?
 - ▶ Unscrambled is “computer”.

Slow Way

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 - ▶ But the number of orderings is $8! = 40,320$, bad!.



Using a Map



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 - ▶ That is "cemoprtu".



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- ▶ Let's use a Map.
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 - ▶ That is "cemoprut".
- ▶ To get ready:



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 - ▶ Solution is to use **List<String>** as the value type.
 - ▶ But we won't do that this time.



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 - ▶ The linked list lets us add quickly once we get there,
 - ▶ but it takes a while to get there.
- ▶ We need a faster way.



SkipList Idea



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- ▶ Suppose we create a linked list which stores the location of every other element of the first list?



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 - ▶ Plus at most one more step in the original list.



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 - ▶ So $n/4 + 1$ instead of $n/2$.



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- ▶ Suppose we create a linked list which stores the location of every other element of the second list?
 - ▶ Get to the middle of the third list in $n/8$.



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 - ▶ To the middle of the second list in $n/8 + 1$.



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 - ▶ To the middle of the second list in $n/8 + 1$.
 - ▶ To the middle of the first list in $n/8 + 2$.



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- ▶ Suppose we create a linked list which stores the location of every other element of the second list?
 - ▶ Get to the middle of the third list in $n/8$.
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- ▶ Keep creating lists!



SkipList Idea

- ▶ Suppose we create a linked list which stores the location of every other element of the first list?
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 - ▶ $n/16 + 3, n/32 + 4, \dots, n/2^k + k - 1$.



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 - ▶ Number of steps is $n/2^{\log_2 n} + \log_2 n - 1 = 1 + \log_2 n + 1 = \log_2 n$

See an example lookup [here](#).



Add and Remove



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 - ▶ Examples of **add**, **find**, and **remove**,



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 - ▶ So on average, we only step forward once per list.
- ▶ $\log_2 n$ steps on average, so $O(\log n)$.



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