CSC148 winter 2014

sorting big-oh
week 10

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Outline

assignment # 2 questions

more big-oh, better sorts

is_regex(s)

Returns **True** if the string s is a valid regular expression, **False** otherwise. Think about. . .

- simplest expressions — how can you check for these **and** reject many strings?
- binary expressions — | and . — how can you check for these? How can you break up the remainder of the string so that you can check it?
- unary expressions — — how can you check for these? how can you break up the remainder of the string so that you can check it?

all_regex_permutations(s)

Returns a set (could be empty) of permutations of s that are valid regular expressions. Think about...

- how to produce a set of permutations? There is lots of code laying about, including in week 4 of this course's calendar
- filter out any permutation that isn't a regex — it would sure be nice to have some code that could test whether a string were a regex...
- a string of length n has n-factorial permutations — producing an impractically large set for $n > 8$.

regex_match(r, s)

Returns **True** if string s matches the regular expression equivalent to the tree rooted at r, **False** otherwise. Think about. . .

- you may assume that r is an instance of one of the specialized regular expression tree classes in **regextree.py**
- what are the simplest cases of string s to consider?
- if the symbol at the root of r is a |, what do you need to check?
- if the symbol at the root of r is a ., what do you need to check?
- if the symbol at the root of r is a $*$, what do you need to check? (more on this next slide)

star regexes...

The handout says that a string s matches a regular expression r* (where r is the child regular expression) if and only if:

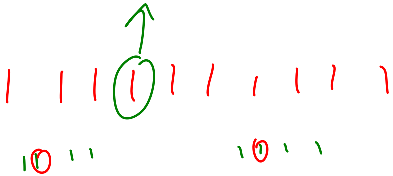
- s is the empty string — pretty easy to check **OR**
- $s = s_1 + s_2 + \cdots + s_k$ where each s_i matches the child regular expression r. This seems harder to check — so many ways to break up s!
- **equivalently (why?)** $s = s_1 + s_2$, where s_1 matches the child regular expression r and s_2 matches r* — now you only have to check every possible way to break s into two pieces.

build_regex_tree(r)

Return the regular expression tree equivalent to the valid (we promise) regular expression **regex**. Think about:

- very similar thinking to **is_regex**
- instead of checking whether **regex** is a regular expression (you are guaranteed that it is), you have to break it into a few pieces to determine which sort of regular expression tree, and provide input strings to form its children (if any)
- strangely, that's all there is to do!

quick sort



idea: choose a pivot; decide where the pivot goes with respect to the rest of the list, repeat on the partitions...

a digression. . .

$f(2) \rightarrow [2]$

$f(3) \rightarrow [2, 3]$

$[3]$

what could go wrong?

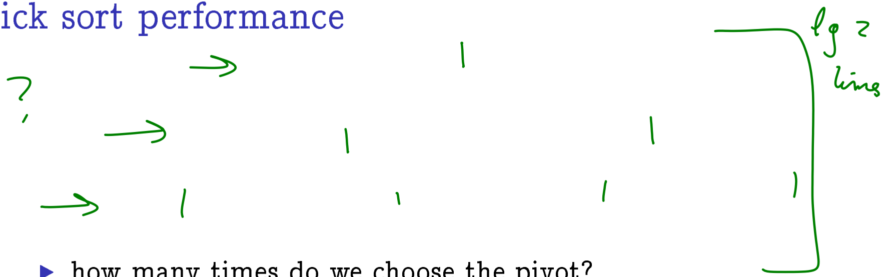
```
def f(n: int, L: list=[]) -> list:
    L.append(n)
    return L
```

$f(7) \rightarrow [7]$

$f(17) \rightarrow [7, 17]$

$[17]$

quick sort performance



- how many times do we choose the pivot?

X

~ n comparisons

O(n lg n)

- how many steps each time we choose a pivot?

merge sort

| | | | | | |

lg n → splitting

~~for~~ each ≤ n comparisons for merge.

→ n lg n

idea: divide the list in half, (merge) sort the halves, then merge the sorted results

merge sort performance

- how many times do we split the list in half?

- how many steps each time we split?

scaling:

How well do these various sorts perform as the size of the problem (list length) increases? Time and compare.