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?

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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.

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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. . .

what could go wrong?

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

quick sort performance

- how many times do we choose the pivot?

- how many steps each time we choose a pivot?

merge sort

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.