Strings

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Relative Frequencies of Letters

Letter	Frequency	Letter	Frequency	Letter	Frequency
e	13%	d	4%	p	2%
t	9%	l	4%	b	1%
a	8%	c	3%	v	1%
o	8%	u	3%	k	1%
i	7%	m	2%	j	0.2%
n	7%	w	2%	x	0.2%
s	6%	f	2%	q	0.1%
h	6%	g	2%	z	0.1%
r	6%	y	2%		

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Using Computers to Solve Problems

- Approach 1: Brute force - try all possible solutions
- Approach 2: Use reasoning to find solution more quickly
- Approach 3: Use heuristic to approximate a solution
- Approach 4: Give up! The answer is not computable!

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Searching for Substrings

- Searching forward from beginning:
  `int position = str.indexOf ("abc");`
- Searching backward from end:
  `int lastPosition = str.lastIndexOf ("abc");`
- Searching forward from a starting point:
  `int position = str.indexOf ("abc", 15);`
- Searching backward from a starting point:
  `int position = str.lastIndexOf ("abc", 15);`

Returns -1 if substring is not found.

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Replacing text in middle of a String

"I love Joe" => "I hate Joe"

To replace "love" with "hate":

1. Find where "love" starts
2. Extract the substring from the beginning to where "love" starts
3. Concatenate "hate" to the substring from step 2
4. Extract the substring from where "love" ends and concatenate this to the string from step 3.

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Replacing text in middle of a String

"I love Joe" => "I hate Joe"

To replace "love" with "hate":

1. int start = str.indexOf ("love");
2. Extract the substring from the beginning to where "love" starts"
3. Concatenate "hate" to the substring from step 2
4. Extract the substring from where "love" ends and concatenate this to the string from step 3.

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Replacing text in middle of a String

"I love Joe" => "I hate Joe"

To replace "love" with "hate":

1. int start = str.indexOf ("love");
2. String newString = str.substring (0, start);
3. Concatenate "hate" to the substring from step 2
4. Extract the substring from where "love" ends and concatenate this to the string from step 3.

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Replacing text in middle of a String

"I love Joe" => "I hate Joe"

To replace "love" with "hate":

1. int start = str.indexOf ("love");
2. String newString = str.substring (0, start);
3. String newString = newString + "hate"
4. Extract the substring from where "love" ends and concatenate this to the string from step 3.

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Replacing text in middle of a String

"I love Joe" => "I hate Joe"

To replace "love" with "hate":

```
int start = str.indexOf ("love");
String newString = str.substring (0, start);
newString = newString + "hate";
newString = newString + str.substring (start + 4);
```

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Replacing All Occurrences of a String

```
public void replaceAll(String oldString, String newString) {
    int searchStart = 0;

    // Find the first occurrence of the string
    int replaceStart = document.indexOf (oldString, searchStart);

    // Keep going as long as there are more occurrences
    while (replaceStart != -1) {
        // Replace the occurrence just found
        String start = document.substring (0, replaceStart);
        String last = document.substring (replaceStart + oldString.length());
        document = start + newString + last;

        // Look for another occurrence of the string
        searchStart = replaceStart + newString.length();
        replaceStart = document.indexOf (oldString, searchStart);
    }
}
```

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