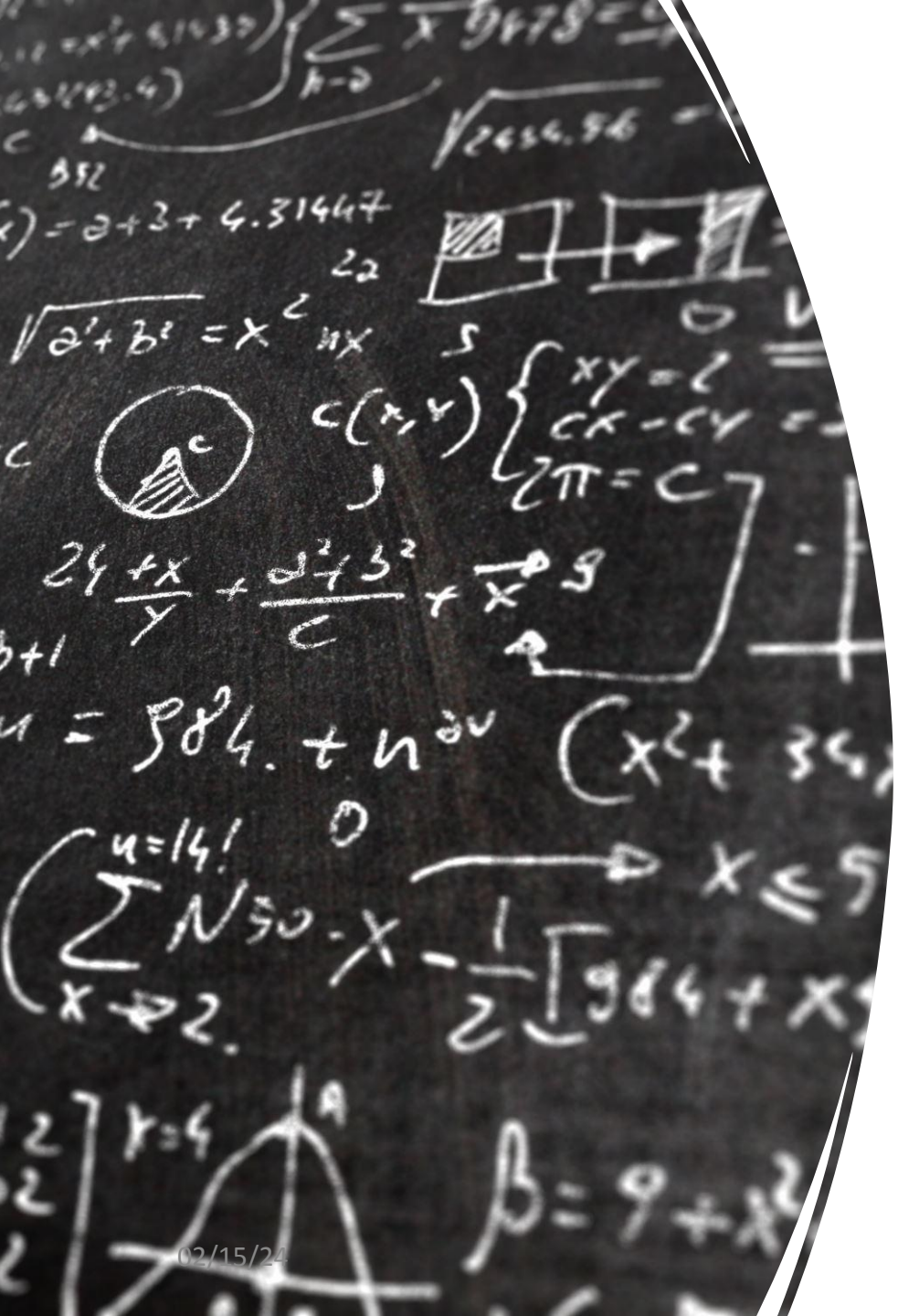

CS 113 – Computer Science I

Lecture 08 – String Methods & Recursion

Thursday 02/15/2024

Announcements

- HW02 deadline extended to Sunday

Answer the Piazza OH poll

Agenda

String Comparison review

Recursion

Comparing strings

- In Java, you cannot directly compare strings using ==

- Instead, use **compareTo**
  - Javadocs: https://docs.oracle.com/javase/7/docs/api/java/lang/String.html

Recursion

Recursion

a function that calls itself

Base case that handles the smallest problem

Rule that *does something* then *calls itself* on a smaller version of the problem

Recursion example – print “hello” 5 times

Base case: When the number of times to print is 0, stop printing

Rule: Print “hello” once and then print “hello” 4 times

Recursion

a function that calls itself

Each recursive call should move towards a base case where a direct solution can be found.

Base case that tells us when to stop

Rule that *does something* then *calls itself* on a smaller version of the problem

Recursive functions – base case

Conditional statement that prevents infinite repetitions

Usually handles cases where:

- input is empty
- problem is at its smallest size

Recursion Example - Factorial

- What is a factorial? n!
- product of all integers less than or equal to n
  - n! = n * n-1 * n-2 ….. 1
  - 5! = 5 * 4 * 3 * 2 * 1
  - 4! = 4 * 3 * 2 * 1
  - 3! = 3 * 2 * 1

- Factorial.java
- What is the base case?

Visualizing recursion – Factorial example

factorial(5) =

= 5 * factorial(4)

= 5 * 4 * factorial(3)

= 5 * 4 * 3 * factorial(2)

= 5 * 4 * 3 * 2 * factorial(1)

= 5 * 4 * 3 * 2 * 1

Exercise: Blast Off

Write a recursive method: `void BlastOff(int n)`

Which prints a count down from n to 1 and then prints “Blast off!”

Example:
`BlastOff(3)` prints

```
3
2
1
Blast off!
```

Recursion Example – Contains letter

Write a method called “containsLetter” that determines if a String contains a given character

Question: What are the parameters?

1. The character to look for
2. The string to be looking in

Question: What is the return type?

Recursion Visualization – Contains letter

contains(“l”, “apple”) =

    contains(“l”, “apple”)

        contains(“l”, “pple”)

            contains(“l”, “ple”)

                contains(“l”, “le”)

                    return true

Recursion containsLetter

Recursion Example – printVowels

Your turn!

Write a recursive function that prints just the vowels in a String

Recursion Example – IndexOf letter

Your turn again! Write a method called IndexOf.

Arguments: String (haystack), Character (needle)

Return: the index of the character in the String. You can assume needle is in haystack.

Recursion limitations

- Limited number of times we can recurse
  - Stackoverflow – too many frames
- Potentially memory inefficient
  - If we copy data in subproblems – we'll worry about this in a few weeks
- Performance: might duplicate unnecessary work
  - We'll define performance later in the semester

Style gg=G

- How we format our programs is **very** important
  - Like rules of etiquette around eating and keep a clean appearance
  - Like punctuation rules, it helps make text more readable

- Variable names should be descriptive

- Indentation is **very** important
  - Every statement inside a pair of braces must be indented

- Braces should be placed consistently