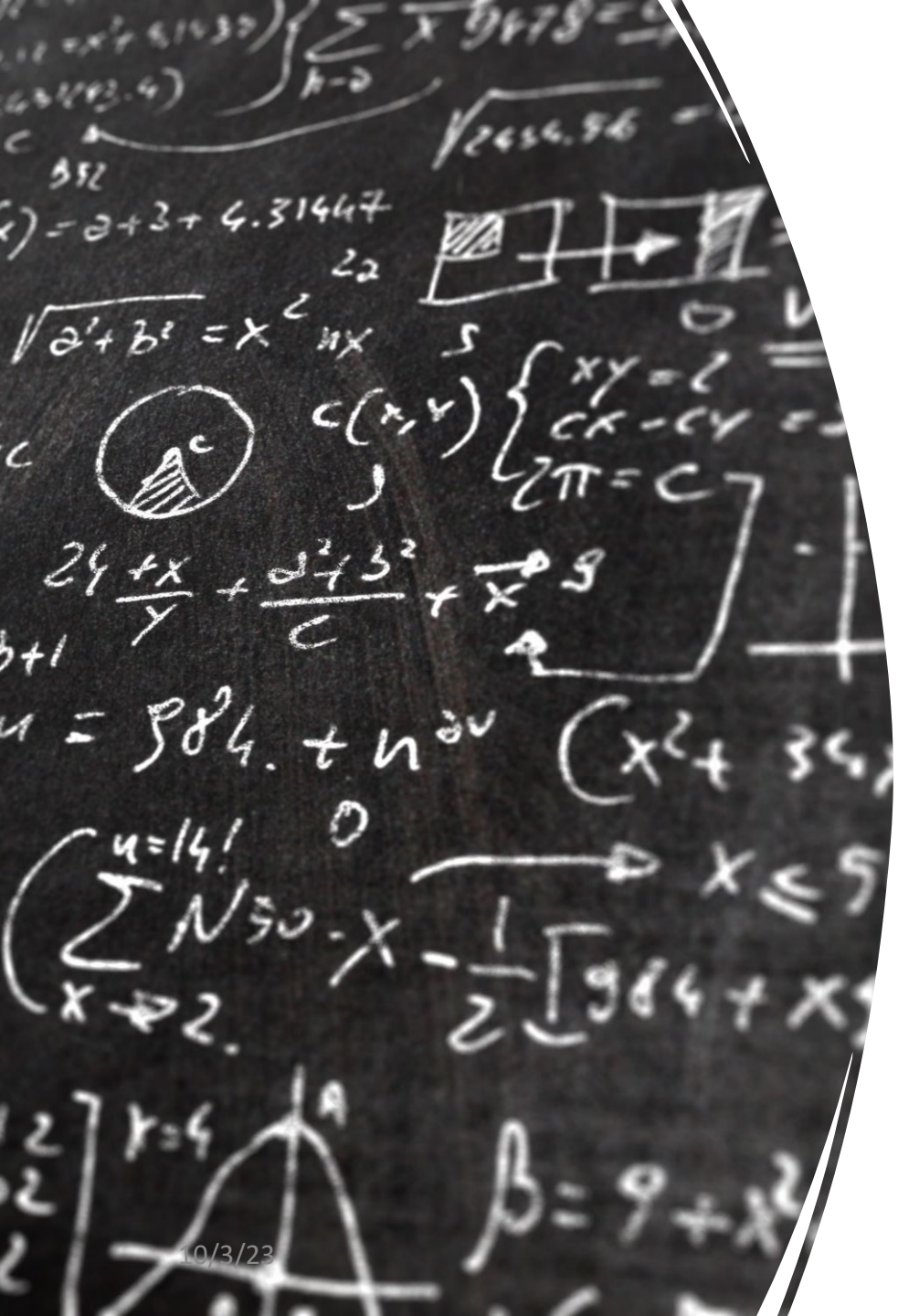


CS 113 – Computer Science I

Lecture 09 – Recursion, Strings, Arrays

Tuesday 10/03/2023

Announcements

- HW03 – moved deadline to tonight 10/03
- HW04 – due Monday 10/09
  First write method stubs, and upload programs with method stubs to Gradescope
  Ensures method signatures are correct
- Project 01 – Due Monday 10/09
  - Implement Blackjack!
  - Paired assignment – can work with a partner
- Midterm 1 – Thursday 02/12

Announcements - Collaboration Policy

Discuss approaches to problems, and to sketch out general solutions

MUST write up the homework answers, solutions, and programs individually without sharing specific details, i.e. code

Announcements – Collaboration Policy

Gradescope automatically compares your assignments and gives a similarity score (it's a percentage).

If the percentage is very high, it's a sign that code was shared

First offense:

0 points on that portion of the assignment

Second offense:

0 points on the assignment

Third offense:

Let's not get there

Agenda

Recursion - review

Arrays – reviews

Misc for Blackjack

Strings and Arrays as Objects

Recursion Example – printVowels

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

User Input

Ask a user for their first and last name

If the user doesn’t give a first and last name, prompt them again

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

Arrays

Arrays

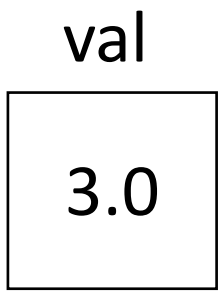
Idea: Store multiple values into a single variable

Values are sequential

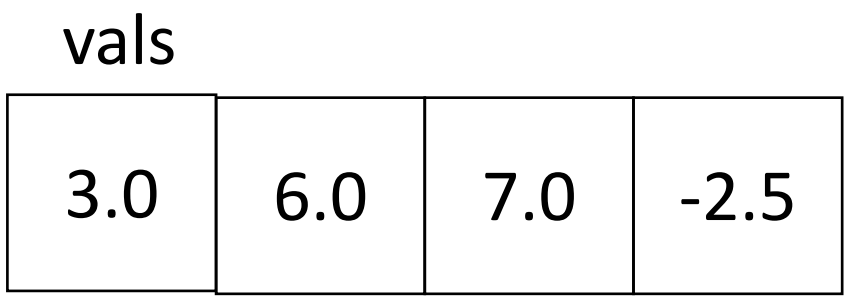
Analogous to a list

Arrays

```
double val = 3.0;
```




```
double[] vals = {3.0, 6.0, 7.0, -2.5};
```



Arrays

Three ways to initialize an array

1. With an initial value
```
int[] numbers = {1, 2, 5};
```
2. With allocated space, but uninitialized
```
int[] numbers = new int[3];
```
3. With an empty array reference
```
int[] numbers = null;
```

Array Indexing

Access individual elements of an array with indexing

array[index]

Variable name

Integer

We use *zero*-based indexing

first element is **0**

last element is **length-1**

Accessing indices out of range results in a **runtime error**!

Recursion Example – printList

Write a recursive function that prints the contents of an array

Command line arguments

```
public static void main(String[] args)
```

Command line arguments are an *array of String*

Exercise: Write a program called commandLineArgs.java that

1) prints out 3 command line arguments that are passed in.
2) Compute the sum of three command line arguments (assuming they are integers)

Random from Range

Say we want to choose a random number between 100-200 (exclusive)

Math.random() creates a random double between 0 and 1

Multiply that by the range (max – min)

Add the result to the min value

Useful for Blackjack project

Agenda

Recursion - review

Arrays – reviews

Misc for Blackjack

Strings and Arrays as Objects

Initializing empty arrays

```
int[] nums = new int[3];
    [0, 0, 0]


String[] strs = new String[3];
    [null, null, null]
```

```java
public static void add1(int[] list, int pos) {
  if (pos >= list.length) {
    return;
  }
  list[pos] += 1;
  add1(list, pos+1);
}

public static void add1(int[] list) {
  add1(list, 0);
}

public static void main(String[] args) {

  int[] numbs = {10, 20, 30};
  printList(numbs);
  add1(numbs);
  printList(numbs);
}
```

What is numbs after we call add1?

Objects

Strings and arrays are **NOT** primitives

They are objects

Explains why we can’t use “==“ to compare Strings

“==“ checks if two objects are the same

not if the two values are the same

2-D Arrays – Arrays of Arrays