

Welcome to CMSC351

# Question

We know from CMSC 250 that there is no such thing as “integer closure under division” and that sometimes an integer divided by an integer is also an integer and other times it is not.

Is the following an integer?

# Question

Given an array of integers and a target value, we want to know whether there is a way to add up a sub-group of that list to get the target.

Take the next 5 minutes (without searching online) and write up on paper a pseudocode solution that will take as input an array and a target and answer this question correctly.

# Question

Will the following algorithm work to determine whether a binary tree is a binary search tree if you pass in its root?

```
boolean testBST(Node root) {  
    boolean answer = true;  
    if (root.left != null) {  
        answer = answer &&  
            root.val >= root.left.val &&  
            testBST(root.left);  
    }  
    if (root.right != null) {  
        answer = answer &&  
            root.val <= root.right.val &&  
            testBST(root.right);  
    }  
    return answer;  
}
```

# “Syllabus” Issues

- Prerequisites for course:
  - CMSC 250  $\leftarrow$  MATH 141
  - CMSC 216  $\leftarrow$  CMSC 132
- Homework assignments, practice and thought problems, quizzes, aporés, projects
- Three Semester Exams
- Final Exam (cumulative)
- Office Hours and possibly Q&A sessions
- E-mail contact:  
egolub@glue.umd.edu

Read the full syllabus!!!

# Details, Form, Style

Computer Science encompasses many things, but in most of them you will find that while the degree differs:

- Details matter.
- Form matters.
- Style matters.

Some factors that make this so

- we want others to be able to review/confirm our work
- we want others to be able to continue on from our work
- we want to have confidence that our approach is leading to something that is correct

# Review your logarithm rules.

$$(\log_a b = c) \equiv (a^c = b)$$

$$\log_a (xy) = \log_a x + \log_a y$$

$$\log_a (x/y) = \log_a x - \log_a y$$

$$\log_a (x^p) = p \log_a x$$

$$\log_a x = \frac{\log_b x}{\log_b a}$$

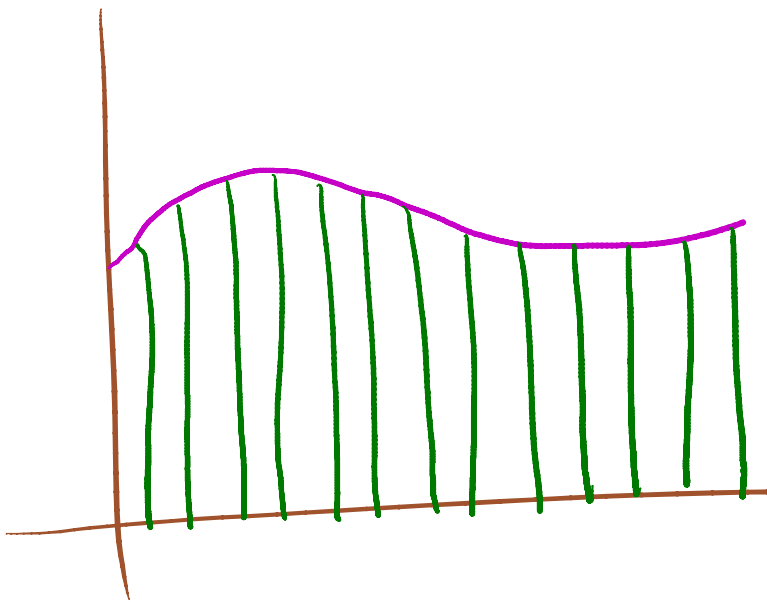
$$\log_a a^x = x$$

$$a^{\log_b y} = y^{\log_b a}$$

# What is an Integral?

Area under a curve.

Sum of area of rectangles under the curve as rectangles widths approach zero.



How do you draw the top of the rectangles?



# Review your Integrals.

$$\int x^r dx = \frac{1}{r+1} x^{r+1}$$

$$\int \frac{1}{x} dx = \ln x$$

$$\int u dv = uv - \int v du$$

$$\int (\ln x) dx = ???$$

# Growth Rate of Functions

$$f(n) = 1$$

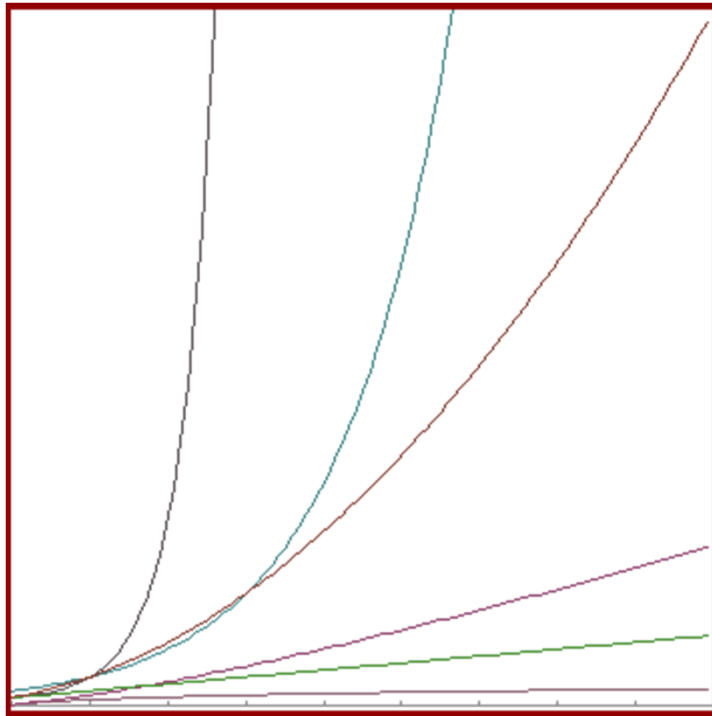
$$f(n) = \log n$$

$$f(n) = n \log n$$

$$f(n) = n^2$$

$$f(n) = 2^n$$

$$f(n) = n^n$$



- Which grows faster?
- How do you *prove* that?
- We will explore this in *much* more detail this semester.

# Review the “expected value” of a random variable.

You have 26 suitcases with values inside of:

- .01, 1, 5, 10, 25, 50, 75, 100, 200, 300, 400, 500, 750, 1000, 5000, 10000, 25000, 50000, 75000, 100000, 200000, 400000, 500000, 750000, 1000000
- If you select one suitcase at random, what is the expected value of the contents?

Generally, the expected value is:

- $E(x) = \sum P_i x_i$  where  $P_i$  is the probability of  $x_i$  being the actual value.

# CMSC 351

What is an algorithm?

What types of algorithms exist?

What will we be learning in this class?

# Use constructive induction...

Use constructive induction to set values for **a** and **b** in the following equation:

$$\sum_{i=1}^n i = an^2 + bn$$

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