

ES 2: Critical thinking with Python

aka, Introduction to Computing for Engineers

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Plan for this week

Some more open-ended problems where you write code to analyze a problem or data

Some datasets

Write a 1-sentence description for each of these datasets:

grades1 = [98, 90, 12, 92, 90, 91, 93, 99, 93, 93, 99, 94]

grades2 = [87, 87, 87, 87, 87, 87, 87, 87, 87, 87, 87, 87]

grades3 = [81, 82, 83, 91, 92, 93, 81, 82, 83, 91, 92, 93]

grades4 = [98, 76, 74, 99, 99, 73, 76, 98, 77, 97, 99, 78]

Making a histogram

- 1) Define the bins
- 2) "Bin" the data
- 3) Plot the number of items in each bin

```
samples = [88, 90, 12, 92, 77, 71, 93, 99, 93, 83, 99, 14]
```

Histograms can lie too...

What happens as you change the number and spacing of bins?

Algorithms

How to solve a problem:

- 1) Write down the problem
- 2) Think very hard
- 3) Write down the answer

A better way

How to solve a problem:

- 1) Solve an example of the problem by hand
- 2) Write down the steps for what you just did
- 3) Generalize your steps
- 4) Test your algorithm

(From Hilton & Bracey, *All of Programming*)

Algorithm practice

Determine if a string is a palindrome "RACECAR"

Challenge: Determine if an integer is a palindrome number

Algorithm practice

Find the second-largest number in a list

Challenge: Think of at least two more ways to do this

For bigger problems

You can't solve it all at once!

What is one small piece that you **can** solve, and test to make sure it's working?

"Code a little, test a little"

The roomba problem

It's 2005 or so, and you're designing the "navigation" algorithm for a vacuum-cleaner robot.

You want to build a simulation that will let you try different algorithms and evaluate how effectively they cover the room.

Side note: random numbers

Computers generally don't have truly random numbers
But pseudo-random numbers are usually good enough!

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But pseudo-random numbers are usually good enough!

`np.random.seed()` Start the random number generator
in a known state

`np.random.randint()`

Solar panel project due Friday at midnight

Start working on Roomba problem

We'll be looking at signal analysis on Thursday