Discrete Structures: CMPSC 102

Oliver BONHAM-CARTER

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Week 13

Saha, Chapter 4: Sympy

- Doing symbolic math with Python
- Note: we may have to use Python2 to study the libraries.

- Can you see the difference between 2.8284271247461903 and 2*sqrt(2)?
  - These are both the results of $\sqrt{8}$.

- Using a large floating point value may have eventual rounding errors and is difficult to track when following the steps in working out mathematical work
- SymPy makes working with math easier as the notation is conserved during the work.

Simplifying Square Roots

Using Python2

```
import sympy
sympy.sqrt(8)  # 2*sqrt(2)
sympy.sqrt(20) # 2*sqrt(5)
```

Input:

$\sqrt{8}$

Input:

$\sqrt{20}$

Exact result:

$2\sqrt{2}$

Exact result:

$2\sqrt{5}$

Decimal approximation:

2.8284271247461900976033774

Decimal approximation:

4.472135954999579392818⁩

Graphics from: `https://www.wolframalpha.com`

The Step-By-Step Way

- When you work each step of the math by hand, you can see how the results are generated.

Using Python2

- $\sqrt{8} = \sqrt{4*2} = \sqrt{4}*\sqrt{2} = 2*\sqrt{2} = 2.83$
- $\sqrt{20} = \sqrt{4*5} = \sqrt{4}*\sqrt{5} = 2*\sqrt{5} = 4.47$

Endless Possibilities

What else can this system do?!

(you tell me!)

https://www.sympy.org

- Sympy is a symbolic manipulation library for python.
- You can work with math where the computed values remain in the contexts of fractions, equations, etc (otherwise these values would be immediately converted to floating points, for example)

Participation 5
Search for this repository and push work to it

Place work in:
`cs102-participation-starters/05_part_starter/`
and push it

- In your repository: `mkdir 05_part_starter/`
- Note: Participation checks are given only for **work done while you are in class**.
- Time limit: Push your work by the end of class (12pm) for credit.

- Details on next slide...

- You are to follow the *introduction* to SymPy tutorial at
  - https://docs.sympy.org/latest/tutorial/intro.html
  - https://docs.sympy.org/latest/tutorial/

- Use the interactive interpreter to play with the code. Save your work in a source file /05_part_starter/sympyDemo.py along with a comment line of what the code sample is doing.
  Note: you will have to create this directory for the file.

- *Write your code to be run to re-create your study!*

- Time permitting, find another section of the tutorial to follow. Keep this work in the same file with comments