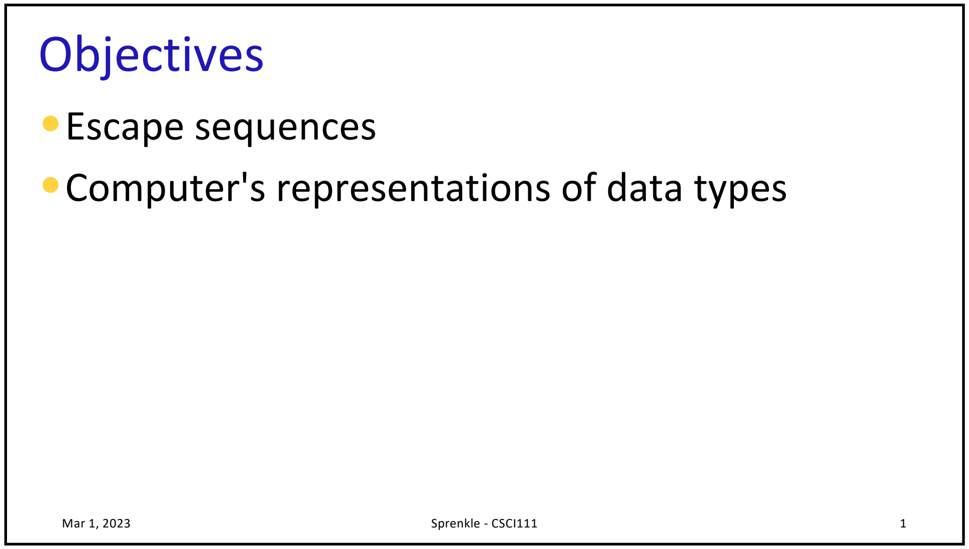
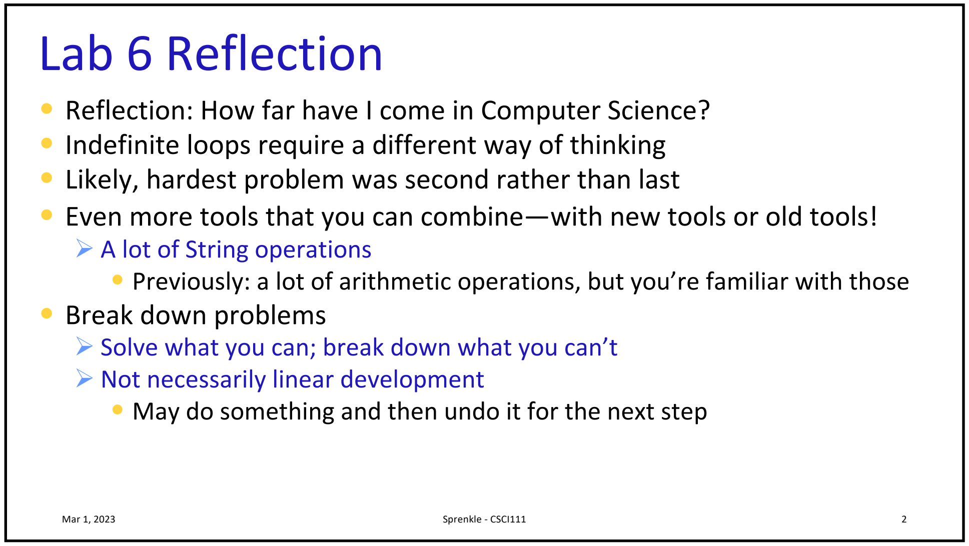


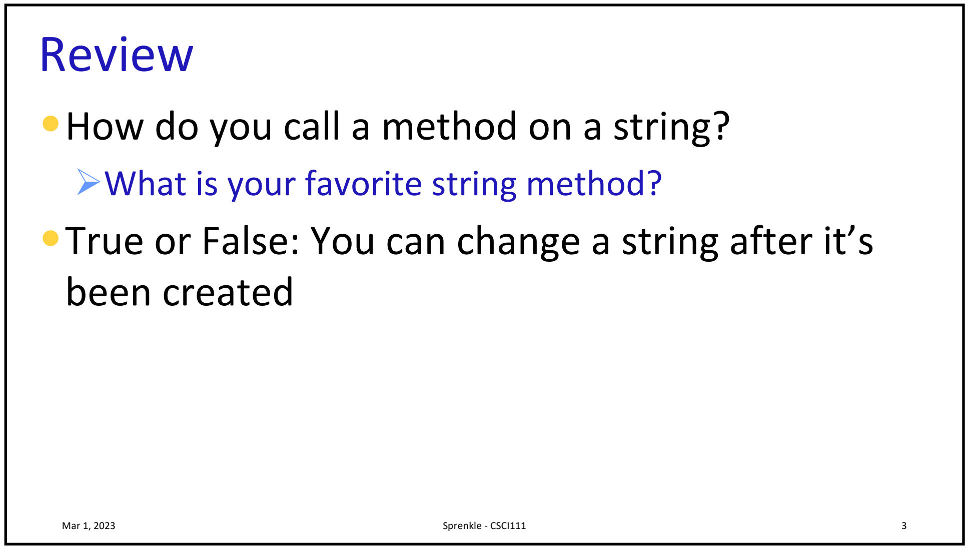
Objectives

- Escape sequences
- Computer's representations of data types



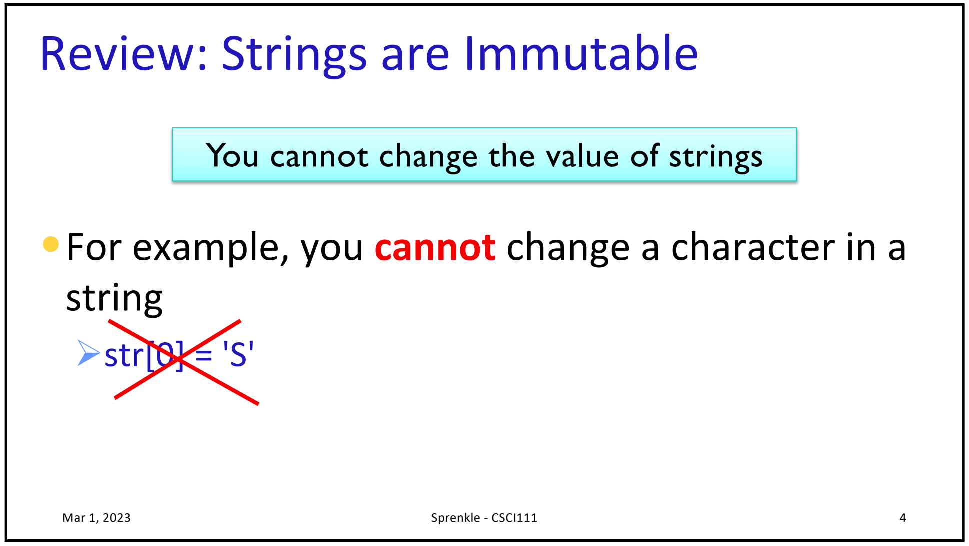
Lab 6 Reflection

- Reflection: How far have I come in Computer Science?
- Indefinite loops require a different way of thinking
- Likely, hardest problem was second rather than last
- Even more tools that you can combine—with new tools or old tools!
  - A lot of String operations
    - Previously: a lot of arithmetic operations, but you're familiar with those
- Break down problems
  - Solve what you can; break down what you can't
  - Not necessarily linear development
    - May do something and then undo it for the next step



Review

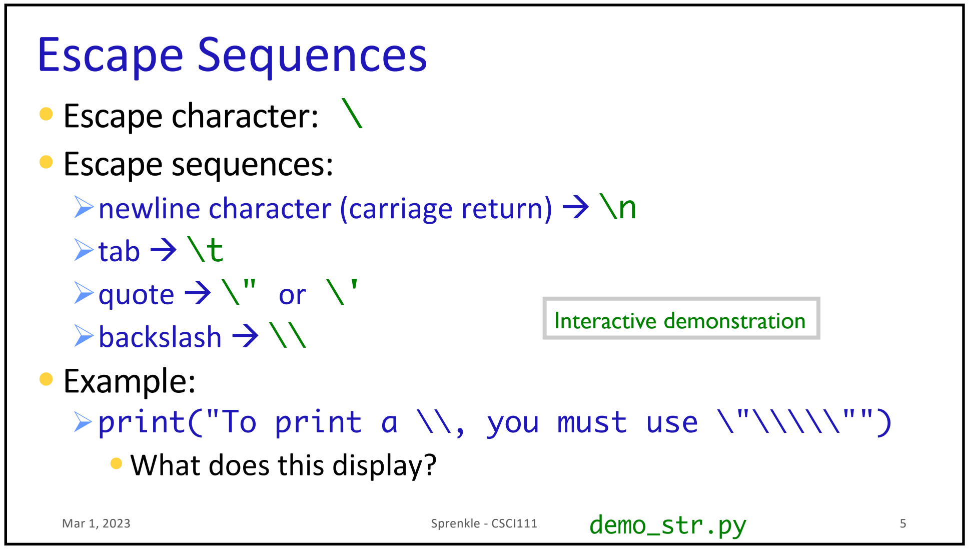
- How do you call a method on a string?
  - What is your favorite string method?
- True or False: You can change a string after it’s been created



Review: Strings are Immutable

You cannot change the value of strings

- For example, you **cannot** change a character in a string
  - ~~str[0] = 'S'~~

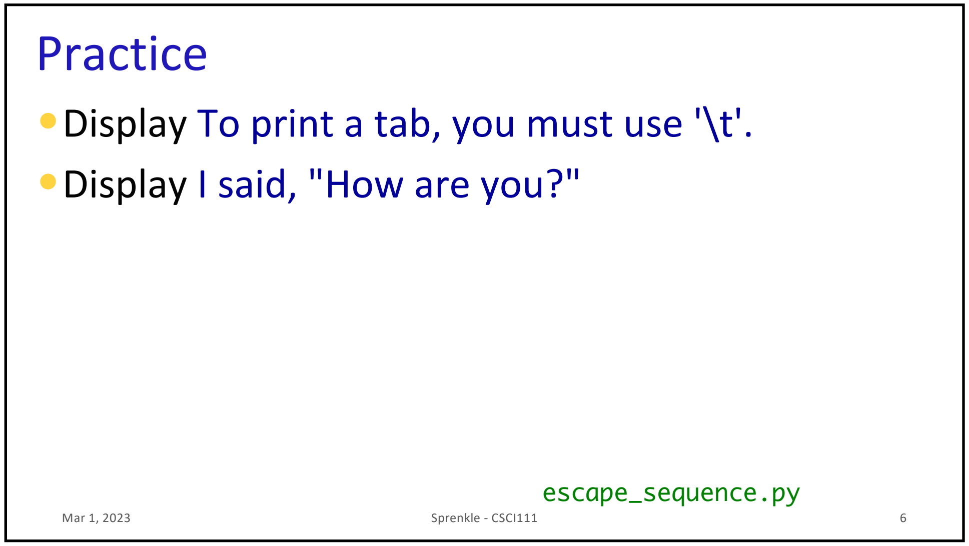


Escape Sequences

- Escape character: `\`
- Escape sequences:
  - newline character (carriage return) → `\n`
  - tab → `\t`
  - quote → `\"` or `\'`
  - backslash → `\\`
- Example:
  - `print("To print a \\, you must use \"\\\\\"")`
    - What does this display?

Interactive demonstration

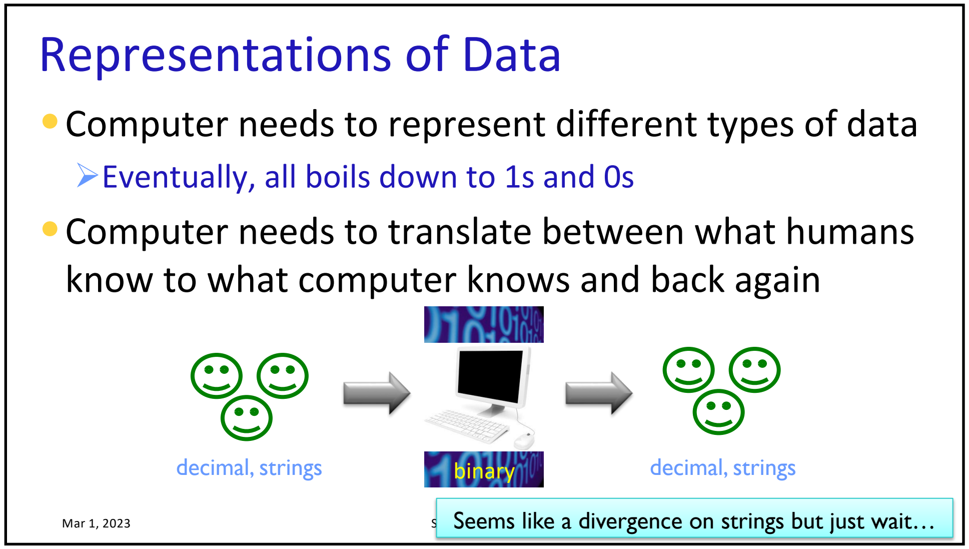
demo_str.py



Practice

- Display To print a tab, you must use '\t'.
- Display I said, "How are you?"

escape_sequence.py

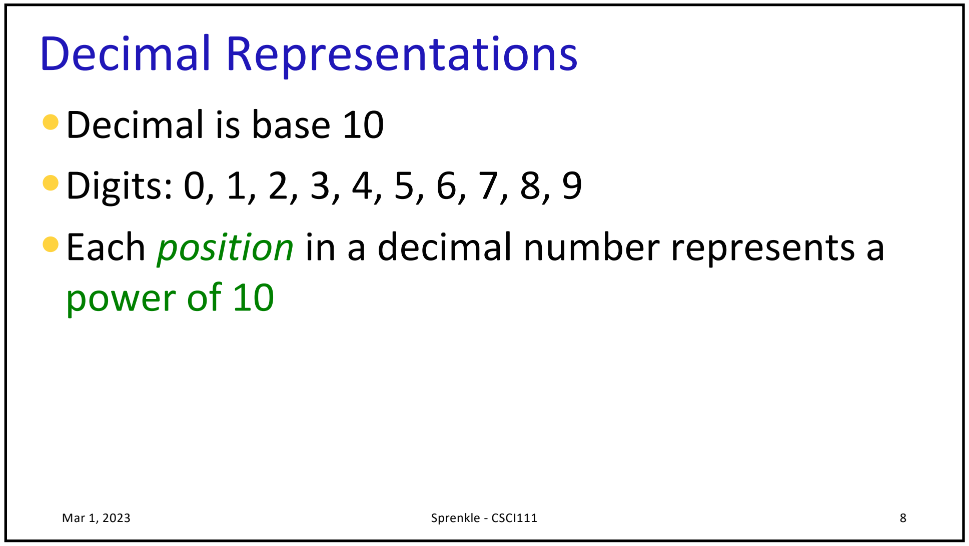


Representations of Data

- Computer needs to represent different types of data
  - Eventually, all boils down to 1s and 0s
- Computer needs to translate between what humans know to what computer knows and back again

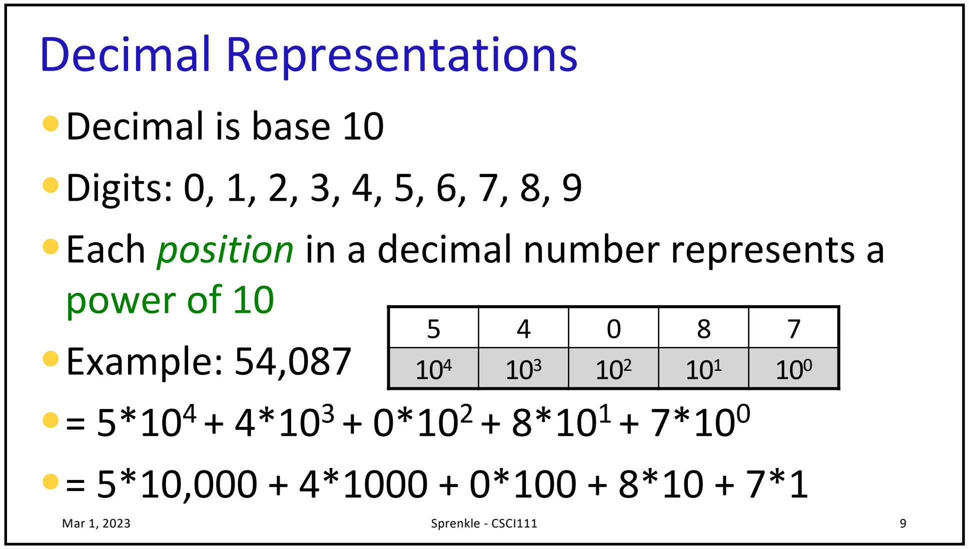
decimal, strings
binary
decimal, strings

Seems like a divergence on strings but just wait…



Decimal Representations

- Decimal is base 10
- Digits: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9
- Each *position* in a decimal number represents a power of 10

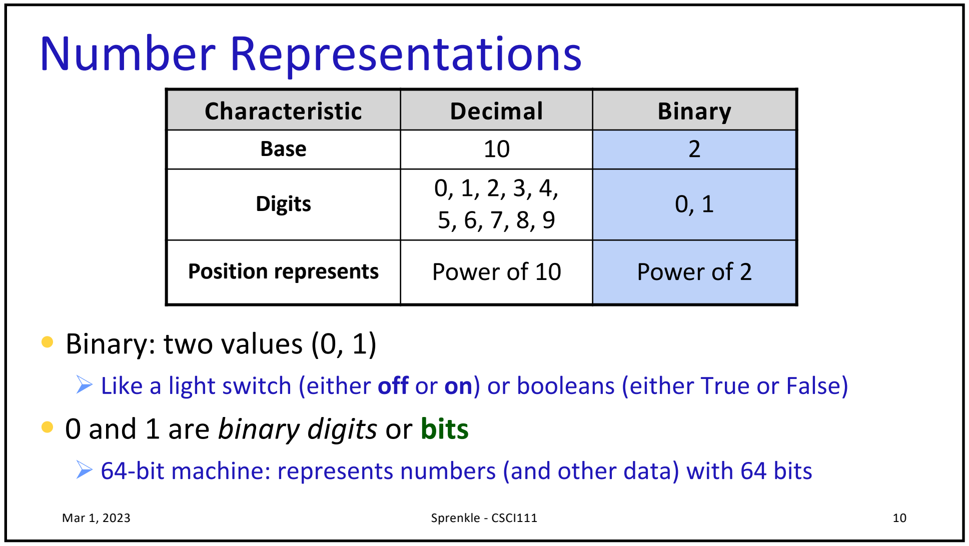


Decimal Representations

- Decimal is base 10
- Digits: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9
- Each *position* in a decimal number represents a power of 10
- Example: 54,087

5	4	0	8	7
10^4	10^3	10^2	10^1	10^0

- = $5*10^4 + 4*10^3 + 0*10^2 + 8*10^1 + 7*10^0$
- = 5*10,000 + 4*1000 + 0*100 + 8*10 + 7*1



Number Representations

Characteristic	Decimal	Binary
Base	10	2
Digits	0, 1, 2, 3, 4, 5, 6, 7, 8, 9	0, 1
Position represents	Power of 10	Power of 2

- Binary: two values (0, 1)
  - Like a light switch (either **off** or **on**) or booleans (either True or False)
- 0 and 1 are *binary digits* or **bits**
  - 64-bit machine: represents numbers (and other data) with 64 bits

Binary Representation

- Binary number: 1101

1	1	0	1
2^3	2^2	2^1	2^0

- $= 1*2^3 + 1*2^2 + 0*2^1 + 1*2^0$
- $= 1*8 + 1*4 + 0*2 + 1*1$
  - Decimal value: 13

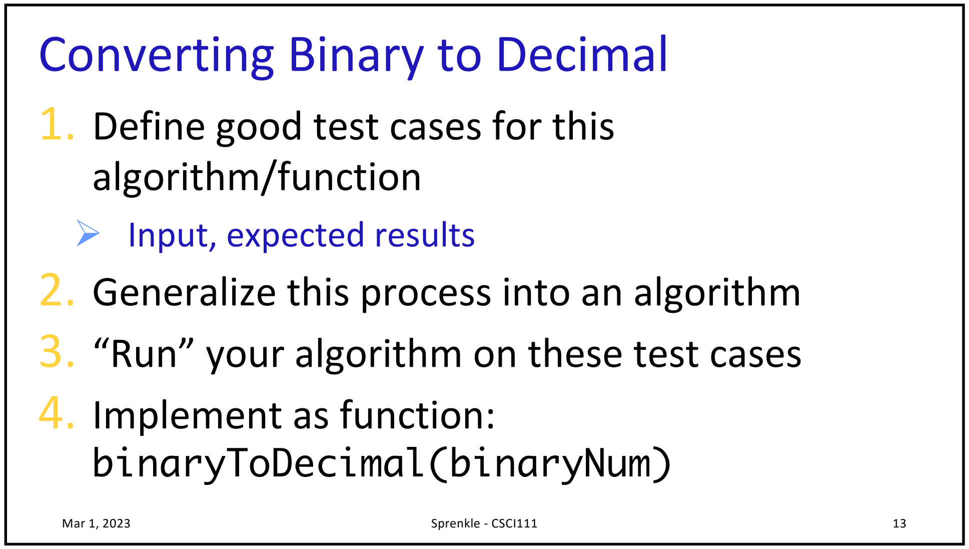
Practice: what is the decimal value of the binary number **10110**?

Binary Representation

- Binary number: 10110

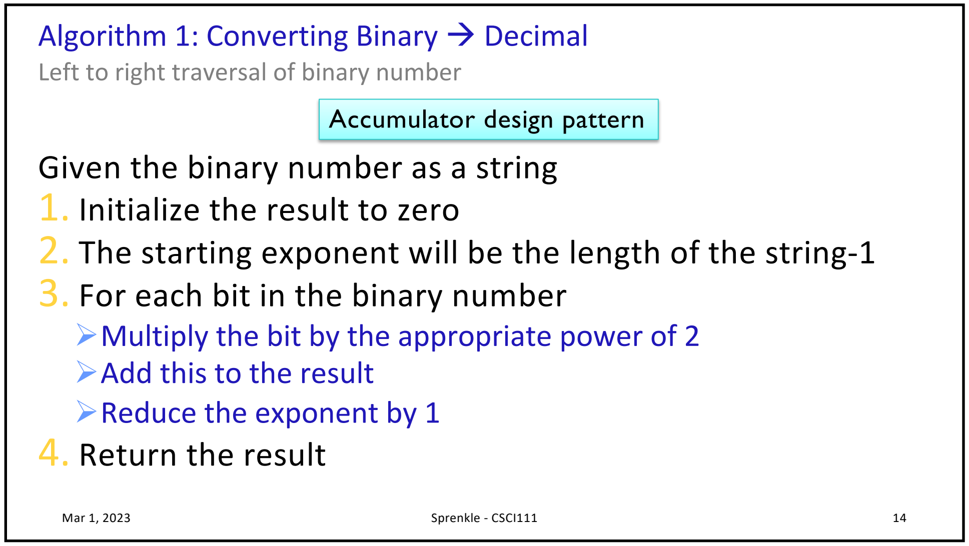
1	0	1	1	0
2^4	2^3	2^2	2^1	2^0

- $= 1*2^4 + 0*2^3 + 1*2^2 + 1*2^1 + 0*2^0$
- $= 1*16 + 0*8 + 1*4 + 1*2 + 0*1$
  - 22



Converting Binary to Decimal

1. Define good test cases for this algorithm/function
   - Input, expected results
2. Generalize this process into an algorithm
3. “Run” your algorithm on these test cases
4. Implement as function: `binaryToDecimal(binaryNum)`



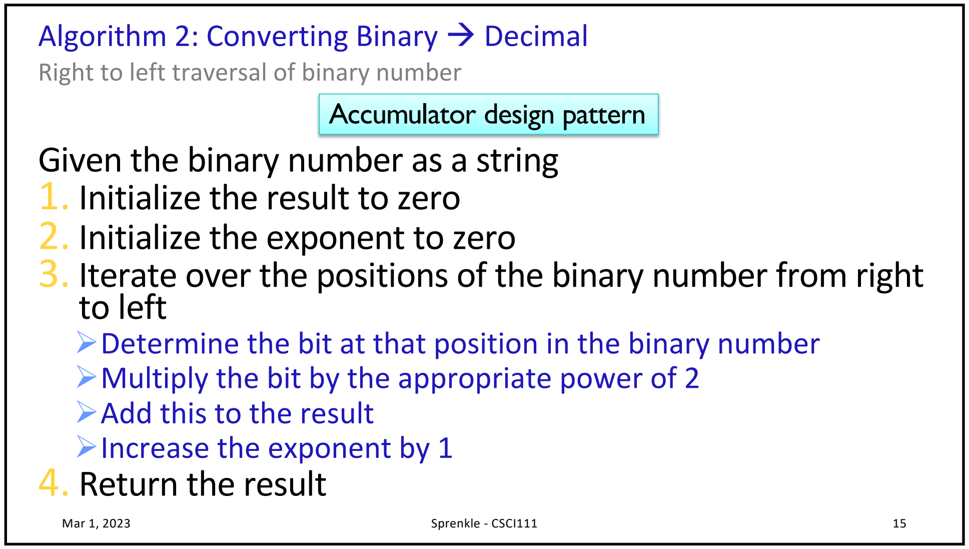
Algorithm 1: Converting Binary → Decimal

Left to right traversal of binary number

Accumulator design pattern

Given the binary number as a string

```
1. Initialize the result to zero
2. The starting exponent will be the length of the string-1
3. For each bit in the binary number
    ➢Multiply the bit by the appropriate power of 2
    ➢Add this to the result
    ➢Reduce the exponent by 1
4. Return the result
```



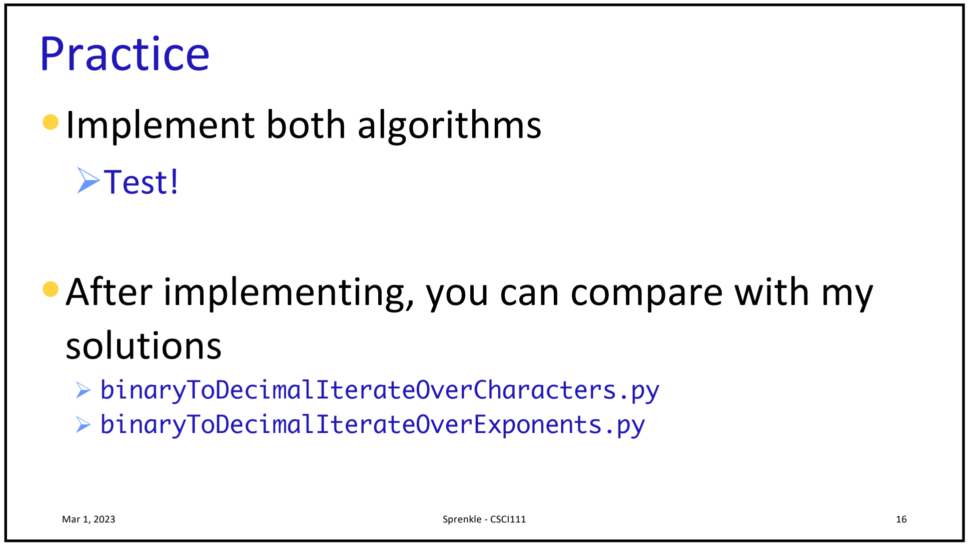
Algorithm 2: Converting Binary → Decimal

Right to left traversal of binary number

Accumulator design pattern

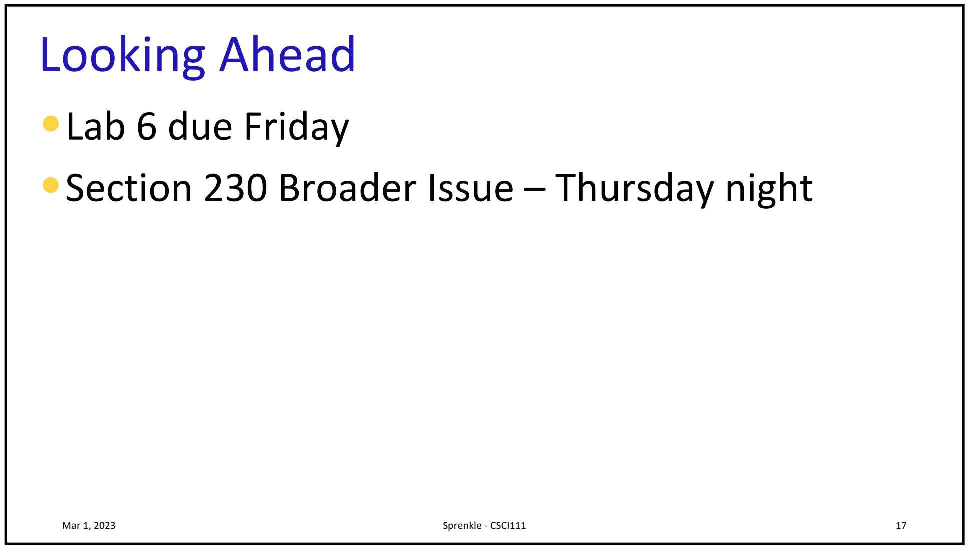
Given the binary number as a string

1. Initialize the result to zero
2. Initialize the exponent to zero
3. Iterate over the positions of the binary number from right to left
   - Determine the bit at that position in the binary number
   - Multiply the bit by the appropriate power of 2
   - Add this to the result
   - Increase the exponent by 1
4. Return the result



Practice

- Implement both algorithms
  - Test!
- After implementing, you can compare with my solutions
  - `binaryToDecimalIterateOverCharacters.py`
  - `binaryToDecimalIterateOverExponents.py`



Looking Ahead

- Lab 6 due Friday
- Section 230 Broader Issue – Thursday night