Objectives

- More: computer's representations of data types
- Encryption
- Broader Issue: Section 230

1

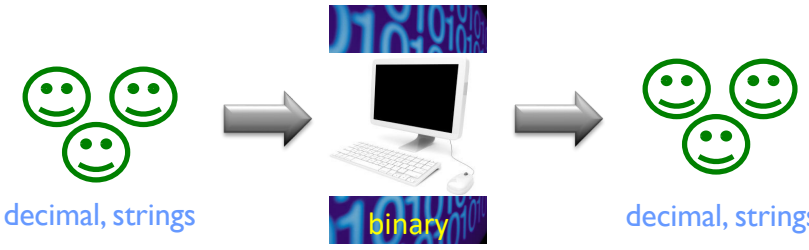
Review

- What is the special name for sequences, like newlines, tabs, …?
  - How do we represent them in strings?
- How does the computer represent data (e.g., numbers and text)?
- What is your algorithm for converting binary to decimal?

2

Review: 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



Seems like a divergence on strings but just wait…

3

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)`

4

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

5

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

6

Practice

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

Algorithm: Converting Decimal → Binary

Given the decimal as an integer…

1. Initialize the result to the empty string
2. Repeat until the decimal is 0:
   - result = str(decimal % 2) + result
   - decimal = decimal // 2
3. Return the result

1. Try out algorithm with 22 as input
2. Implement algorithm in function `decimalToBinary`
   - Good test cases?

`decimalToBinary.py`

String Representations

- A **string** is a *sequence* of characters
- Each character is stored as a binary number
- **ASCII** (American Standard Code for Information Interchange) is one standard encoding for characters
  - Limitation: ASCII is based on the English language
  - Cannot represent other types of characters
  - Handout is just a subset
- Unicode is a new standard

Translating to/from ASCII

- Translate a character into its ASCII numeric code using **built-in function** `ord`
  - `ord('a') ==> 97`
- Translate an ASCII numeric code into its character using **built-in function** `chr`
  - `chr(97) ==> 'a'`

`ascii_table.py`
`ascii.py`

ASCII Questions

- Lowercase letters are represented by what range of numbers?
- Uppercase letters are represented by what range of numbers?
- What is the difference between the decimal encoding of 'M' and 'N'?
  - Between 'm' and 'n'?
- Explain why `"Zebra" < "aardvarks"` evaluates to True

ASCII Questions

- Lowercase letters are represented by what range of numbers?
  - 97—122
- Uppercase letters are represented by what range of numbers?
  - 65—90
- What is the difference between the decimal encoding of 'M' and 'N'?
  - Between 'm' and 'n'?
  - 1
- Explain why `"Zebra" < "aardvarks"` evaluates to True
  - `ord("Z") < ord("a")`

Translating to/from ASCII

- Translate a character into its ASCII numeric code using **built-in function** `ord`
  - `ord('a')` evaluates to `97`
- Translate an ASCII numeric code into its character using **built-in function** `chr`
  - `chr(97)` evaluates to `'a'`

`ascii_table.py`
`ascii.py`

Encryption

- Process of encoding information to keep it secure
- One technique: Substitution Cipher
  - Each character in message is replaced by a new character

Caesar Cipher

- Replace character with a character X places away
  - X is called the ***key***
- Julius Caesar used technique to communicate with his generals
- "Wrap around" within the lowercase letters
- Write program(s) to do this in next lab

Original Letter	Key	Encrypted Letter
'a'	1	'b'
'b'	1	'c'
'z'	1	'a'

Caesar Cipher

- Using the ASCII handout, what would be the encoded messages?

Message	Key	Encoded Message
apple	5	
zebra	5	
the eagle flies at midnight	-5	

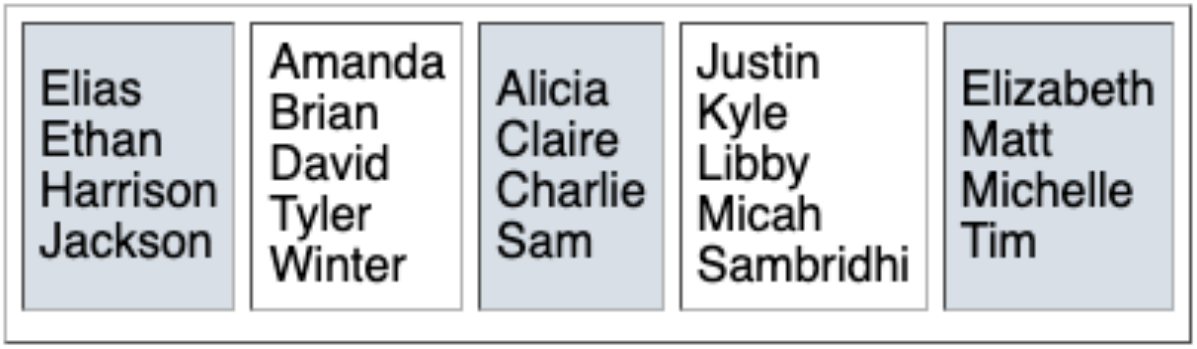
Caesar Cipher

Message	Key	Encoded Message
apple	5	fuuqj
zebra	5	ejgwf
the eagle flies at midnight	-5	ocz zvbgz agdzn vo hdyidbco

What is your algorithm for the encoding process?
→ Break into pieces
How would you *decode* an encrypted message?

17

Broader Issue



18

Broader Issue: Section 230

- What is Section 230?
  - What was the reasoning for the 1996 law?
  - Did it work as intended?
- What is the bipartisan criticism of Section 230?
  - Not that the criticism is the same!
- Comment on "Justice Elena Kagan joked: 'We really don't know much about these things. You know, these are not, like, the nine greatest experts on the internet.'"
- Play Supreme Court: Pick a side!

19

Broader Issues: Takeaways

- Rules impact how people play the game
- Are algorithms free speech?

20

Looking Ahead

- Pre Lab 7 due before lab
  - Some repetition with last week's lab, as we go into more depth on some topics