

Objectives

- Computer's representations of data types

Review

- What is the special name for sequences, like newlines, tabs, ...?
 - How do we represent them in strings?
- How can we get fine-grained control over how our data is displayed?

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

Generalize this process into an algorithm...

Oct 25, 2017

Sprenkle - CSCI111

3

Algorithm: Converting Binary → Decimal

Accumulator design pattern

1. Read in the binary number as a string
 - The starting exponent will be the length of the string-1
2. Initialize the result to zero
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. Display the result

Implement algorithm
`binaryToDecimal.py`

Oct 25, 2017

Sprenkle - CSCI111

4

Algorithm: Converting Decimal → Binary

1. Read in the decimal as an integer
2. Initialize the result to the empty string
3. Repeat until the decimal is 0:
 - `result = str(decimal % 2) + result`
 - `decimal = decimal // 2`
4. Display the result

Try out algorithm with 22

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**
- Unicode is a new standard

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' ?

Oct 25, 2017

Sprenkle - CSCI111

7

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

Oct 25, 2017

Sprenkle - CSCI111

8

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'

Oct 25, 2017

Sprenkle - CSCI111

`ascii_table.py`
`ascii.py`

9

Encryption

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

Oct 25, 2017

Sprenkle - CSCI111

10

Caesar Cipher

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

Oct 25, 2017

Sprenkle - CSCI111

11

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	

Oct 25, 2017

Sprenkle - CSCI111

12

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?
How would you *decode* an encrypted message?

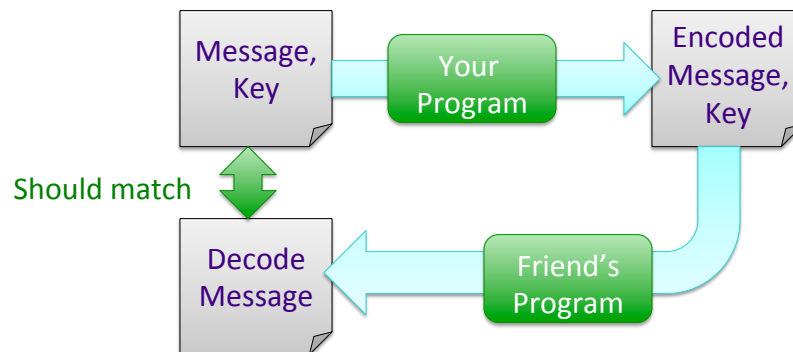
Oct 25, 2017

Sprenkle - CSCI111

13

Next Lab

- Write an encoding/decoding program
 - Encode a message
 - Give to a friend to decode



Oct 25, 2017

Sprenkle - CSCI111

14

Caesar Cipher (Partial) Algorithm

- For each character in the message
 - Check if the character is a space; if it is, it stays a space
 - Otherwise
 - Convert the character to its ASCII value
 - Add the key to that value
 - Make sure that the new value is a “valid” ASCII value, i.e., that that new value is in the range of lowercase letter ASCII values
 - If not, “wrap around” to adjust that value so that it’s in the valid range
 - Convert the ASCII value into a character

Oct 25, 2017

Sprenkle - CSCI111

15

Broader Issue: Sentiment Analysis

Aimee
Gabe
JD
Katlin
Utkrist

Alex
Amalia
Chris
Daniel
Max

Angel
Drew
Liam
Pengrui
Tristan

Annie B.
Prakriti
Rinn
Sam
Turner

Abhi
Isaac
Landon
Pranam

Oct 25, 2017

Sprenkle - CSCI111

16

Broader Issue: Sentiment Analysis

- How are words/phrases in this article that wouldn't make sense to you before the class but do now?
 - What are words/phrases that you still don't know?
- What is sentiment analysis?
 - Where would sentiment analysis be useful?
- How would you implement sentiment analysis?
- How would you test sentiment analysis?