CMPT 120 LECTURE 7-1

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7-1 HOUSEKEEPING

Review announcements

- Midterm, assignment

7-1

- Review: min and max
- Talk through completed example of recommender system
- New material: bits, bytes, and codes (not on midterm)

MIN AND MAX

Pseudo code:

- Initialize a variable to hold max (min). It should be smaller (larger) than items
- Iterate through items
- If item is larger (smaller) thatn current value of variable, store it in our variable
- After all items are seen, we have the max

MAX: CODE

```
values = [3, 5, 2, 8, 6]
maximum = values[0]
for value in values:
    if value > maximum:
        maximum = value
print(maximum)  # 8
```

```
8
```

INDEX OF MAX

How to keep track of the *index* of the max or min?

INDEX OF MAX: CODE

```
values = [3, 5, 2, 8, 6]
maximum = values[0]
index_of_max = 0
for i in range(len(values)):
    value = values[i]
    if value > maximum:
        maximum = value
        index_of_max = i
print(maximum, i)
```

```
8 4
```

VARIABLES USED FOR MAX

To find the person with a max or min score in a file, how many variables do you need to use? What data types will you use?

- Answer: just one number!

REVIEW REC SYS

```
# select a user + init variables to keep track of scores
index_of_user = 17
top_score = 0
top_record = ""
recommendation = ""

# load data
with open("fake_data.csv", "r") as file:
    all_lines = file.readlines()
    header = all_lines[0]
    records = all_lines[1:]

    user_record = records[index_of_user].strip().split(",")

    # use a loop to go through all other record lines (one record = one use
    for record in records:
        columns = record.strip().split(",")
```

CONCEPT REVIEW: NESTED LOOPS

- What does it mean to have a nested loop?

ANSWER:

Loop within a loop!

basic breakdown of how nested loops work:

- The outer loop begins its first iteration.
- As the outer loop runs, it encounters the inner loop.
- The inner loop then runs to completion.
- Once the inner loop finishes, the outer loop moves to its next iteration and the inner loop runs again.
- This process continues until the outer loop has completed all of its iterations.

CONCEPT REVIEW: LISTS

How do we add items to a list?

How do we access the second item of a list?

How do we access the second to last item of a list?

BINARY NUMBERS AND ASCII

- New content!
- Not on midterm.
- Why learn: it's how information is stored on our computers

IMMERSION PROGRAM

01001000 01100101 01101100 01101100 01101111
00100000 01010111 01101111 01110010 01101100
01100100

JUST KIDDING!

Fun fact – there's a binary message in the room where I studied computing science!
https://newsroom.ucla.edu/stories/a-coded-message-hidden-in-floor-247232

WHY BINARY

What are (digital) computers?

- Machines that convert low and high electrical signals into 0’s and 1’s
- Then we do some magic with the 0’s and 1’s

BITS

A bit is single unit of information that has either the value zero or one

- 0
- 1

BYTES

A byte is 8 bits

USING DECIMAL TO REPRESENT NUMBERS

In “decimal” (aka numbers you are used to seeing), e.g. 10, 250, 11713 each digit represents powers of ten.

In the number ‘345’

- the 3 represents 3 * 10^3 = 300, because 10^2=100
- the 4 represents 4 * 10^1 = 40
- The 5 represents 5 * 10^0 = 5

As we add digits to the *left* hand side of our decimal numbers, we get higher powers of ten

USING BINARY TO REPRESENT NUMBERS

In the binary the bits represents powers of 2

- 1 (2^0)
- 2 (2^1)
- 4 (2^2 = 2 * 2)
- 8 (2^3 = 2 * 2 * 2)
- 16 (2^4 = 2 * 2 * 2 * 2)
- ...

EXAMPLE OF 2 DIGIT BINARY NUMBERS

- 00 -> 0*1* + *0*2 = 0
- 01 -> 1*1* + *0*2 = 1
- 10 -> 0*1* + *1*2 = 2
- 11 -> 0*1* + *1*2 = 3

CHALLENGE

- What is the maximum number we can store with 4 bits
- What about a byte?
- Extreme challenge (trying using your Python terminal): 4 bytes

ANSWER

The maximum number that can be stored with 4 bits is 15

ASCII

- ASCII is a table that maps decimal numbers to characters
- So, if we have a binary number, we can map it to a decimal number and then to a character

CONVERTING BINARY TO DECIMAL IN PYTHON

- Any ideas how we'd do it?

CONVERTING BINARY TO DECIMAL IN PYTHON: THE ANSWER

def binary_to_decimal(binary_str): decimal = 0 length = len(binary_str) for i, bit in enumerate(binary_str): decimal += int(bit) * (2 ** (length - i - 1)) return decimal

EXAMPLE USAGE:

binary_str = “1101” print(f”The decimal representation of binary {binary_str} is {binary_to_decimal(binary_str)}“)

WITH AN EXTRA BUILT-IN METHOD

```
def binary_to_decimal(binary_str):
    return int(binary_str, 2)

# Example usage:
binary_str = "1101"
print(f"The decimal representation of binary {binary_str} is {binary_to_dec
```

```
The decimal representation of binary 1101 is 13
```

QUESTION: WHAT'S THIS CODE?

00FFAA

ANOTHER NUMBERING SYSTEM: HEXADECIMAL

- Used for color representations

AND MORE!

- Unicode
- Mojibake
  - https://en.wikipedia.org/wiki/Mojibake