

# CS 100: More Representations with Bits

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Week 2-1

# Logistics

## Reading: Pattern Chapter 2

## HW 1 Due Thursday

- ▶ Today's Discussion will cover some aspects of the HW
- ▶ Any Questions now?

## Goals Today

- ▶ More bit encodings
- ▶ Boolean Logic

## HW 2

- ▶ Up by Thursday
- ▶ Due Next Week Thursday
- ▶ Sign up for Code.org
  - ▶ Direct link:  
<http://studio.code.org/join/WFPGRG>
  - ▶ Course Code WFPGRG
- ▶ Use your GMU Email address and full name

## Quick Review

- ▶ What are bits?
- ▶ How many bits in a byte?
- ▶ What kinds of things have we used binary for thus far?
- ▶ What's binary number system?

# Bits for Letters: English Characters

## Scheme 1: Placement of 1

|    |                                  |                                   |
|----|----------------------------------|-----------------------------------|
| A  | 1                                | 000000000000000000000000000001    |
| B  | 10                               | 000000000000000000000000000010    |
| C  | 100                              | 0000000000000000000000000000100   |
| D  | 1000                             | 00000000000000000000000000001000  |
| E  | 10000                            | 000000000000000000000000000010000 |
| .. | ...                              |                                   |
| Z  | 10000000000000000000000000000000 | 10000000000000000000000000000000  |

26 bits for 26 Characters

- ▶ Okay, but seems like a lot of 0's...

# English Characters

Scheme 2: Each letter has an associated number

|    |    |       |       |
|----|----|-------|-------|
| A  | 0  | 0     | 00000 |
| B  | 1  | 1     | 00001 |
| C  | 2  | 10    | 00010 |
| D  | 3  | 11    | 00011 |
| E  | 4  | 100   | 00100 |
| F  | 5  | 101   | 00101 |
| .. |    | ...   |       |
| Z  | 26 | 11001 | 11001 |

5 bits for 26 characters

- ▶ 5 bits could handle up to 32 characters

**In general:** X things can be represented by N bits where  $X \leq 2^N$

**Q:** How many bits to represent both UPPER and lowercase English characters?

## Character Coding Conventions

- ▶ Would be hard for people to share words if they interpreted bits as letters differently
- ▶ ASCII is an old standard for which bits mean which characters
- ▶ 7 bits per character, includes upper, lower case, punctuation
- ▶ **Write your name or initials** in All Caps using ASCII coding

| Decimal | Hex | Binary   |   | Decimal | Hex | Binary   |   |
|---------|-----|----------|---|---------|-----|----------|---|
| 65      | 41  | 01000001 | A | 78      | 4E  | 01001110 | N |
| 66      | 42  | 01000010 | B | 79      | 4F  | 01001111 | O |
| 67      | 43  | 01000011 | C | 80      | 50  | 01010000 | P |
| 68      | 44  | 01000100 | D | 81      | 51  | 01010001 | Q |
| 69      | 45  | 01000101 | E | 82      | 52  | 01010010 | R |
| 70      | 46  | 01000110 | F | 83      | 53  | 01010011 | S |
| 71      | 47  | 01000111 | G | 84      | 54  | 01010100 | T |
| 72      | 48  | 01001000 | H | 85      | 55  | 01010101 | U |
| 73      | 49  | 01001001 | I | 86      | 56  | 01010110 | V |
| 74      | 4A  | 01001010 | J | 87      | 57  | 01010111 | W |
| 75      | 4B  | 01001011 | K | 88      | 58  | 01011000 | X |
| 76      | 4C  | 01001100 | L | 89      | 59  | 01011001 | Y |
| 77      | 4D  | 01001101 | M | 90      | 5A  | 01011010 | Z |

## Bits for Pictures? *In-class Credit*

Discuss in groups of 2-4 how bits could be used to represent **pictures** like photos or drawings.

### Include on one piece of paper

- ▶ Short description of your ideas
- ▶ All names from your group
- ▶ NetIDs of all members
- ▶ Hand in by end of class

### Example Work Sheet

```
Chris Kauffman ckauffm2  
Mark Snyder msnyde14  
Kinga Dobolyi kdobolyi
```

```
We would use bits to represent  
a photo by using the first few  
bits to...
```

## Bits for Docs? *In-class Credit*

Discuss in groups of 2-4 how bits could be used to represent **documents** like Word docs, PDFs, or web pages.

### Add to you piece of paper

- ▶ Short description of your ideas
- ▶ All names from your group
- ▶ NetIDs of all members

### Example

```
Chris Kauffman ckauffm2  
Mark Snyder msnyde14  
Kinga Dobolyi kdobolyi
```

We would use bits to represent a document by using the first bits to...



## Next Time

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