



# Programming with C I

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# Binary

- 🛡️ Computers represent everything as bits
- 🛡️ Recall: a byte is 8 bits
- 🛡️ Int: 4 bytes (32 bits)
- 🛡️ What's the largest int we can represent?

$$2^{32} - 1$$

(unsigned)

# Hexadecimal (base 16)

- Binary takes up a lot of space
- Hexadecimal takes few digits but can easily be converted to binary (and vice versa)
  - Hex uses digits 0-9 and a-f
  - 1 hex digit = 4 bits
- 0000 0000 0000 0001 1101 0011 0101 1011
- 1d35b



## Format ints

- %d for decimal
- %b for binary
- %x for hex



## Assign ints

- 0b for binary (ex: 0b11011 is 27)
- 0x for hex (ex: 0x83fa9 is 540585)

# Bitwise Operators

 You know logical operators...&&,||,!

 We will now learn &,|,~,^,<<,>>

 These operate at the bit level

# Table

&

a	b	a & b
1	1	1
0	0	0
0	1	0
0	0	0

# Table

|

a	b	a   b
1	1	1
0	0	1
0	1	1
0	0	0

# Table

**$\wedge$**

a	b	$a \wedge b$
1	1	0
1	0	1
0	1	1
0	0	0



# Table

~

a	$\sim a$
1	0
0	1

# Operators on multiple bits

**AND**

```
  0110
& 1100
----
  0100
```

**OR**

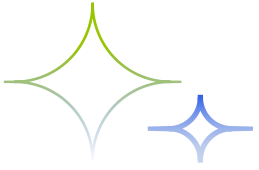
```
  0110
| 1100
----
  1110
```

**XOR**

```
  0110
^ 1100
----
  1010
```

**NOT**

```
  ~ 1100
----
  0011
```



# THE END

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