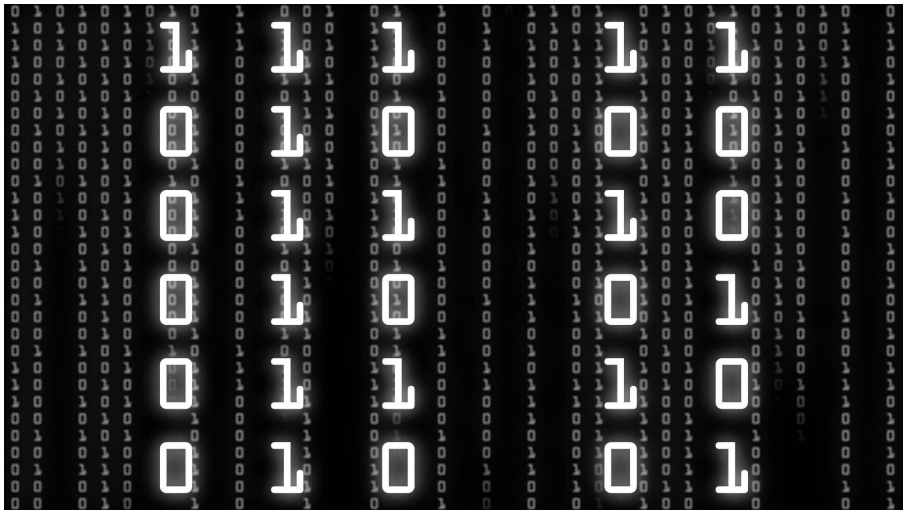
Number Systems

Binary Number System

- One of two numbers: **0** or **1**

- Represents capacitors being off (0) or on (1)



Binary Number System

- Represents the base of computer knowledge
  - Computers, on the most basic level, can only read 1’s and 0’s
  - So we have to translate between them so we can understand what is occurring when we code

Binary Number System

- Translating between binary and base 10 (normal numbers)

- 1 0 1 0 = ??

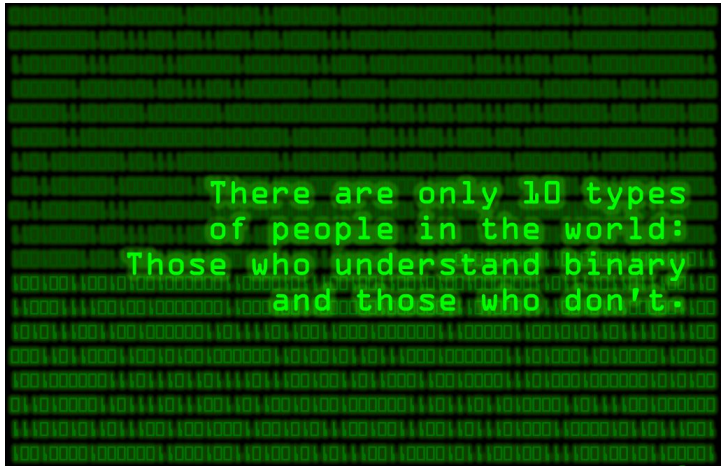
Binary Number System

- Translating between binary and base 10 (normal numbers)

- 1 0 1 0 (binary) = **10_{10} (base 10)**

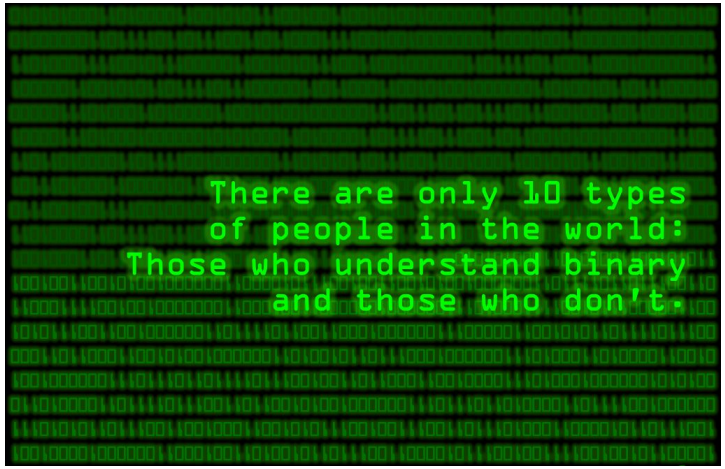
Binary Number System

- 1 1 1 0 0 1 0 1 = ?
- 1 0 0 0 0 = ?
- 1 1 1 1 1 1 1 1 1 = ?
- 1 0 0 0 0 1 1 = ?



Binary Number System

- $1\ 1\ 1\ 0\ 0\ 1\ 0\ 1 = 229_{10}$
- $1\ 0\ 0\ 0\ 0 = 16_{10}$
- $1\ 1\ 1\ 1\ 1\ 1\ 1\ 1\ 1 = 511_{10}$
- $1\ 0\ 0\ 0\ 0\ 1\ 1 = 67_{10}$



Binary Number System

- Formalize it...write the algorithm of how to convert from binary to base 10

Binary Number System

- Converting from base 10 to binary

- 42_{10} = ??

Binary Number System

- Converting from base 10 to binary

- 42_{10} = 101010

Binary Number System

- 16_{10} = ?
- 513_{10} = ?
- 127_{10} = ?
- 99_{10} = ?

Binary Number System

- 16_{10} = 10000
- 513_{10} = 1000000001
- 127_{10} = 1111111
- 99_{10} = 1100011

Binary Number System

- Formalize it...write the algorithm of how to convert from base 10 to binary

Binary Number System

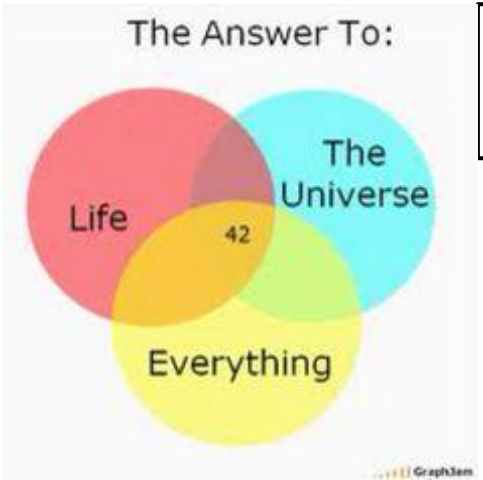
- Converting base 10 to binary - **Divide by Two Algorithm**

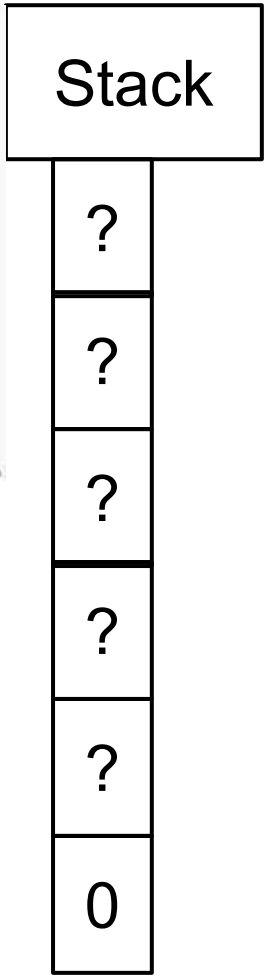
1) Assume the number is > 0
2) Divide the number by 2, write the remainder in a stack (bottom up)
3) When the number is reduced to zero, flip the stack. This is your binary number.

Divide by Two Algorithm

Start with 42

- 42 / 2 = 21, Remainder 0

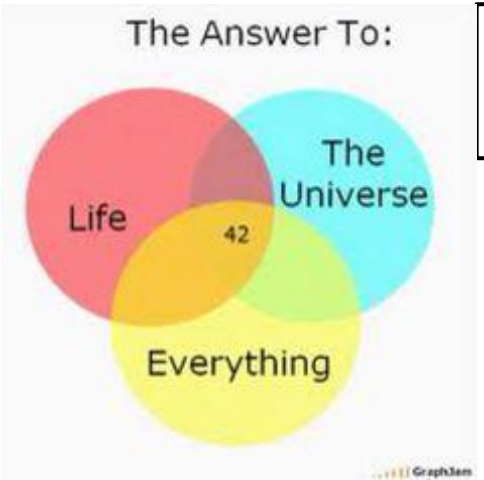


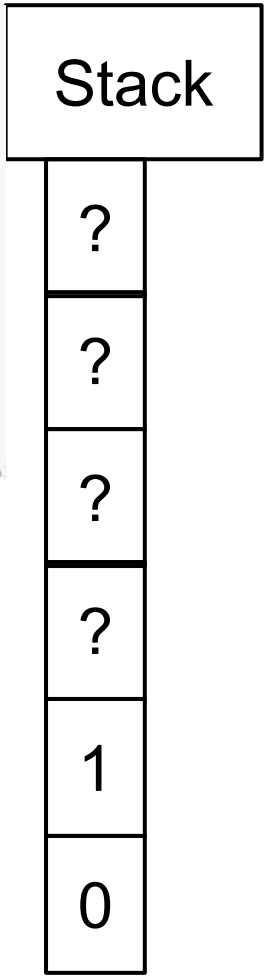


Divide by Two Algorithm

Start with 42

- 42 / 2 = 21, Remainder 0
- 21 / 2 = 10, Remainder 1

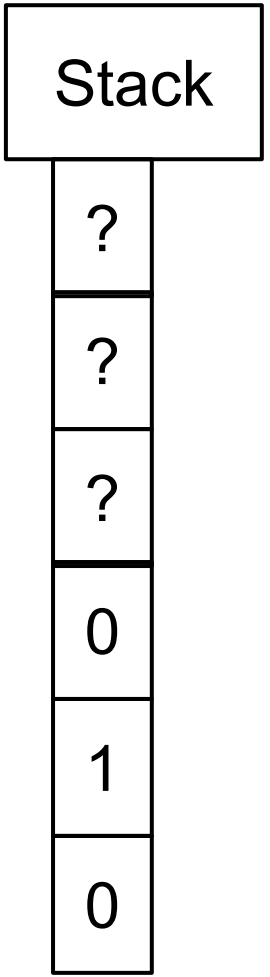




Divide by Two Algorithm

Start with 42

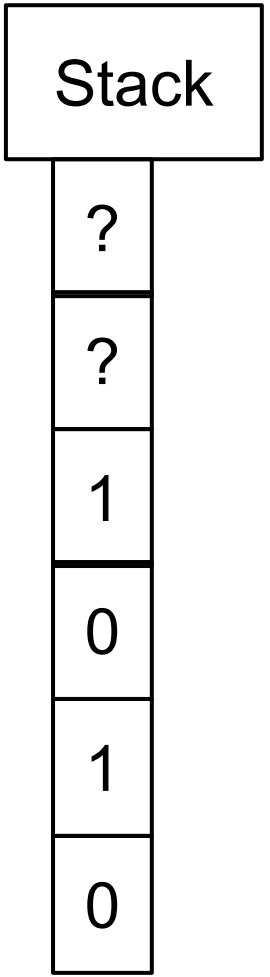
- 42 / 2 = 21, Remainder 0
- 21 / 2 = 10, Remainder 1
- 10 / 2 = 5 , Remainder 0



Divide by Two Algorithm

Start with 42

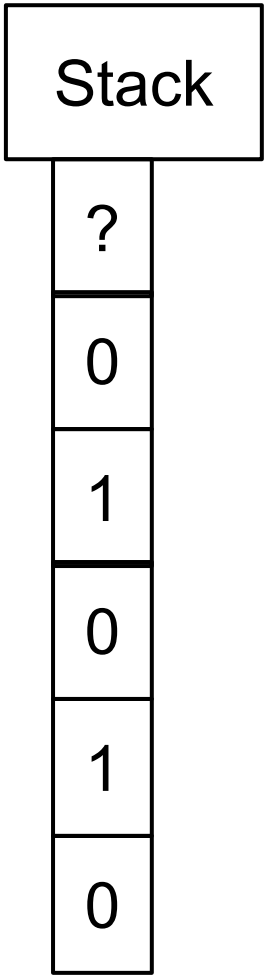
- 42 / 2 = 21, Remainder 0
- 21 / 2 = 10, Remainder 1
- 10 / 2 = 5 , Remainder 0
- 5 / 2 = 2 , Remainder 1



Divide by Two Algorithm

Start with 42

- 42 / 2 = 21, Remainder 0
- 21 / 2 = 10, Remainder 1
- 10 / 2 = 5 , Remainder 0
- 5 / 2 = 2 , Remainder 1
- 2 / 2 = 1 , Remainder 0



Divide by Two Algorithm

Start with 42

- 42 / 2 = 21, Remainder 0
- 21 / 2 = 10, Remainder 1
- 10 / 2 = 5 , Remainder 0
- 5 / 2 = 2 , Remainder 1
- 2 / 2 = 1 , Remainder 0
- 1 / 2 = 0 , Remainder 1