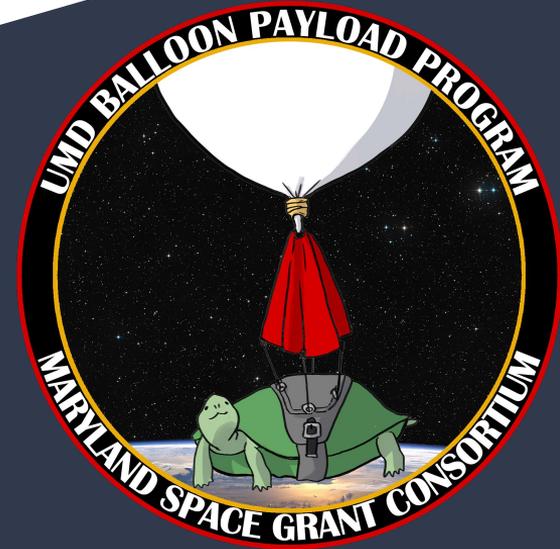


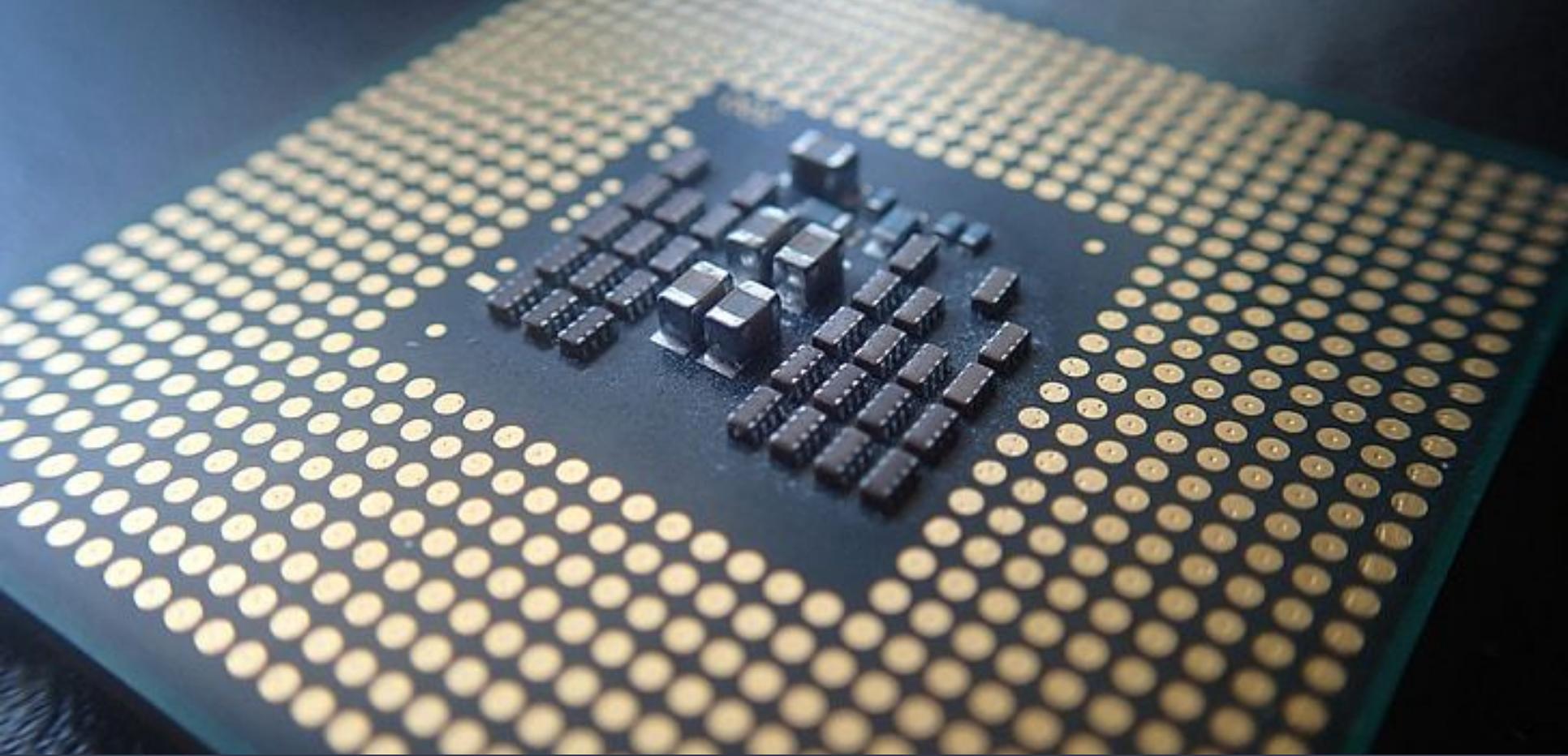
# How To Think Like a Computer

Brought to you by the UMD Balloon Payload Program



What is a **computer**? Why were  
computers invented?





Computer chip - it's really just a bunch of switches!

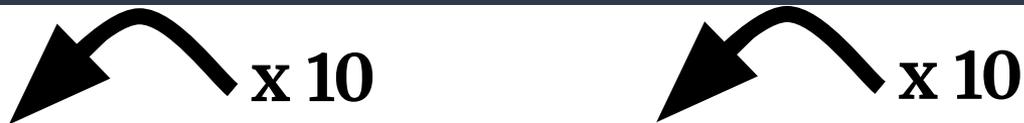
If computers are really just  
**counting machines**, do  
they count like humans?  
How do we count?

# The Base-Ten Counting System

- We count in **base-ten** using our **counting numbers** (0, 1, 2, 3, 4, 5, 6, 7, 8, and 9)
- When we count, we make groups of **ten**
- Base-ten numbers tell us **how many** of those groups we have

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# Base-Ten Place Value Chart



<b>Hundreds</b>	<b>Tens</b>	<b>Ones</b>
<b>3</b>	<b>5</b>	<b>7</b>

What does the 0 mean in this number?

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# Base-Ten Place Value Chart

<b>Hundreds</b>	<b>Tens</b>	<b>Ones</b>
<b>4</b>	<b>0</b>	<b>2</b>

Does this number make sense?

<b>Hundreds</b>	<b>Tens</b>	<b>Ones</b>
<b>5</b>	<b>3</b>	<b>17</b>

A better way to write it:

<b>Hundreds</b>	<b>Tens</b>	<b>Ones</b>
<b>5</b>	<b>4</b>	<b>7</b>

Do computers use **base-ten**?

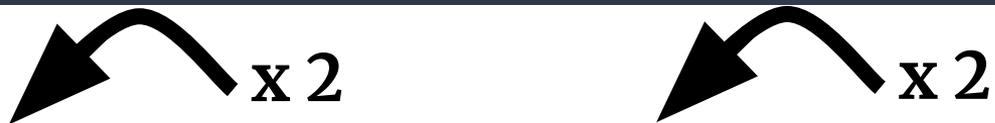


# The Base-Two Counting System

- Computers only know two counting numbers, 0 and 1
- When computers count, they make groups of two
- Programmers call base-two “binary” counting

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# Base-Two Place Value Chart



<b>Fours</b>	<b>Twos</b>	<b>Ones</b>
<b>1</b>	<b>0</b>	<b>1</b>

Can I write this number?

<b>Fours</b>	<b>Twos</b>	<b>Ones</b>
<b>1</b>	<b>0</b>	<b>2</b>

Challenge time: Think like a  
computer!



Find a partner and  
wait for us to pass  
out popsicle sticks

- Count your popsicle sticks with your partner like how a computer would in binary
- Try to write the number of popsicle sticks you have in binary
- Now write the number in base-ten. What do you notice? What looks the same? What looks different?
- Extra Challenge: Try counting your popsicle sticks in another base! What do base-five numbers look like? What if your base is more than ten?

# Image Sources (All Creative Commons or Public Domain)

- [Computer chip](#)
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