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Binary Numbers

Most "normal" people use a base 10 number system. Why?

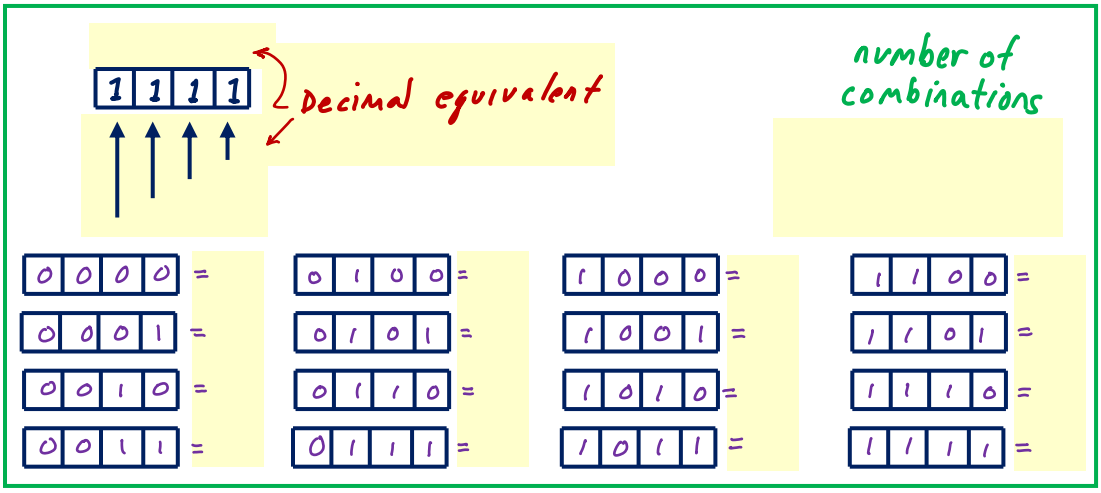
0 1 2 3 4 5 6 7 8 9 — 10 digits

The binary number system is a base 2 number system.

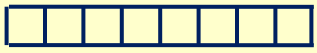
0 1 — 2 digits

Why do we care about binary numbers? Computer systems work because of digital electronics. Computer memory and computer chips work by keeping track of large numbers of on / off "switches." A switch that is **off** is associated with a binary number of **0**; a switch that is **on** is associated with **1**. Patterns of "on" and "off" stored inside a computer are used to encode ordinary numbers. Computer processors that use strings of 64 binary numbers to keep track of things are called 64-bit systems.

Consider the possible combinations of zeros and ones that a 4-bit register can represent.



Arduino Variables: Variables are used to store information in Arduino. We have many choices for the number of bits, or on/off switches, that define each variable.

data type	# of bits	range	comments
boolean	8	true or false	true ≠0 and false = 0
byte	8	0 to 255	an unsigned 8-bit number (2^8=256)
int	16	-32,768 to 32,767	-2^{15} to 2^{15} with a sign bit (most common data type)
long	32	-2,147,483,648 to 2,147,483,647	frequently used data type
float	32	-3.4028235E+38 to 3.4028235E+38	total precision is 6 to 7 digits; includes a decimal
char	8	one 8-bit ASCII character	multiple characters are called "strings"

CLASS PROBLEM: Write the decimal number 20 in binary. What is the smallest size variable required to store the data?