

# Unsigned binary numbers

---

- Each bit represents a power of 2
- For unsigned numbers in a fixed width field
  - » the minimum value is 0
  - » the maximum value is  $2^n - 1$ , where  $n$  is the number of bits in the field
- Fixed field widths determine many limits
  - » 5 bits = 32 possible values ( $2^5 = 32$ )
  - » 10 bits = 1024 possible values ( $2^{10} = 1024$ )

# Binary, Hex, and Decimal

$2^8 = 256_{10}$	$2^7 = 128_{10}$	$2^6 = 64_{10}$	$2^5 = 32_{10}$	$2^4 = 16_{10}$	$2^3 = 8_{10}$	$2^2 = 4_{10}$	$2^1 = 2_{10}$	$2^0 = 1_{10}$	Hex <sub>16</sub>	Decimal <sub>10</sub>
							1	1	0x3	3
					1	0	0	1	0x9	9
					1	0	1	0	0xA	10
					1	1	1	1	0xF	15
				1	0	0	0	0	0x10	16
				1	1	1	1	1	0x1F	31
		1	1	1	1	1	1	1	0x7F	127
	1	1	1	1	1	1	1	1	0xFF	255

# Binary, Hex, and Decimal

Binary <sub>2</sub>	$16^4 = 65536_{10}$	$16^3 = 4096_{10}$	$16^2 = 256_{10}$	$16^1 = 16_{10}$	$16^0 = 1_{10}$	Decimal <sub>10</sub>
11					3	3
1001					9	9
1010					A	10
1111					F	15
1 0000				1	0	16
1 1111				1	F	31
111 1111				7	F	127
1111 1111				F	F	255

# Binary, Hex, and Decimal

Binary <sub>2</sub>	Hex <sub>16</sub>	$10^3 = 1000_{10}$	$10^2 = 100_{10}$	$10^1 = 10_{10}$	$10^0 = 1_{10}$
11	0x3				3
1001	0x9				9
1010	0xA			1	0
1111	0xF			1	5
1 0000	0x10			1	6
1 1111	0x1F			3	1
111 1111	0x7F		1	2	7
1111 1111	0xFF		2	5	5