Numeral Systems, Metric Prefix and Logarithm

Numeral Systems

Binary (base 2): represented by strings of [0, 1]
e.g. "0110111_2"

Decimal (base 10): represented by strings of [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
e.g. "9836_{10}"

Hexadecimal (base 16): represented by strings of [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F]
e.g. "$A38F29_{16}$" or "$BEEF_{16}$" or "$CAFE_{16}$"

Metric Prefix

Note: $2^{10} = 1024 \approx 10^3$

pico	(p)	10^{-12}				**tera**	(T)	10^{12}
nano	(n)	10^{-9}	←	$10^0 = 1$	→	**giga**	(G)	10^9
micro	(μ)	10^{-6}				**mega**	(M)	10^6
milli	(m)	10^{-3}				**kilo**	(k)	10^3

Logarithm

Logarithm reverses the operation of exponentials. In general, $b^y = x$ and $y = log_b x$.
e.g., $2^5 = 32$ *and* $log_2 32 = 5$

Logarithmic Identities:

Product: $\boldsymbol{log_b xy = log_b x + log_b y}$

e.g. $log_{10} 100 = log_{10} 10 + log_{10} 10 = 1 + 1 = 2$

Quotient: $\boldsymbol{log_b \frac{x}{y} = log_b x - log_b y}$

e.g. $log_{10} 1000 = log_{10} 10000 - log_{10} 10 = 4 - 1 = 3$

Power: $\boldsymbol{log_b (x^y) = y\, log_b x}$

e.g. $log_{10} (100^2) = 2\, log_{10} 100 = 2 \cdot 2 = 4$

Change of base: $\boldsymbol{log_b a = \frac{log_{10} a}{log_{10} b}}$ (May use any base, base 10 is arbitrarily chosen here)

e.g. $log_2 8 = \frac{log_{10} 8}{log_{10} 2} = \frac{0.903}{0.301} = 3$