Reference

Hexadecimal

Hex	Binary	Decimal
0x0	0000	0
0x1	0001	1
0x2	0010	2
0x3	0011	3
0x4	0100	4
0x5	0101	5
0x6	0110	6
0x7	0111	7
0x8	1000	8
0x9	1001	9
0xa	1010	10
0xb	1011	11
0xc	1100	12
0xd	1101	13
0xe	1110	14
0xf	1111	15

Powers of Two

Power	Hex	Decimal
2^0	0x0001	1
2^1	0x0002	2
2^2	0x0004	4
2^3	0x0008	8
2^4	0x0010	16
2^5	0x0020	32
2^6	0x0040	64
2^7	0x0080	128
2^8	0x0100	256
2^9	0x0200	512
2^{10}	0x0400	1024
2^{11}	0x0800	2048
2^{12}	0x1000	4096
2^{13}	0x2000	8192
2^{14}	0x4000	16384
2^{15}	0x8000	32768
2^{16}	0x10000	65536

Arithmetic

$$2^a \times 2^b = 2^{a+b}$$
$$2^a * 2^b = 2^{a+b}$$
$$2^a \div 2^b = 2^{a-b}$$
$$2^a \ / \ 2^b = 2^{a-b}$$

HW ISA Instructions

16-bit Encoding (MSB … LSB)

Assembly Syntax	Meaning	Opcode	Rs	Rt	Rd
ADD Rs, Rt, R*d*	R[*d*] ← R[*s*] + R[*t*]	0010	*s*	*t*	*d*
SUB Rs, Rt, R*d*	R[*d*] ← R[*s*] - R[*t*]	0011	*s*	*t*	*d*
AND Rs, Rt, R*d*	R[*d*] ← R[*s*] & R[*t*]	0100	*s*	*t*	*d*
OR Rs, Rt, R*d*	R[*d*] ← R[*s*] | R[*t*]	0101	*s*	*t*	*d*
LW R*t*, *offset*(R*s*)	R[*t*] ← M[R[*s*] + *offset*]	0000	*s*	*t*	*offset*
SW R*t*, *offset*(R*s*)	M[R[*s*] + *offset*] ← R[*t*]	0001	*s*	*t*	*offset*
BEQ R*s*, R*t*, *offset*	If R[*s*] == R[*t*] then PC ← PC + 2 + *offset**2	0111	*s*	*t*	*offset*
JMP *offset*	PC ← *offset**2	1000	*offset*		
HALT	Stops program execution	1111			

JMP offset is *unsigned.* All other offsets are *signed.*

Boolean Laws Reference Sheet

Name of Law / Theorem	Form	Equivalent/Dual form (interchange AND and OR, and 0 and 1)
Identity	$0+A = A$	$1*A = A$
Inverse (or **Complements**)	$A\overline{A} = 0$	$A+\overline{A} = 1$
Commutativity	$A+B = B+A$	$AB = BA$
Associativity	$(AB)C = A(BC)$	$(A+B)+C = A+(B+C)$
Idempotent	$A+A = A$	$AA = A$
Null (or **Null Element**)	$0*A = 0$ (**the Zero Law**)	$1+A = 1$ (**the One Law**)
DeMorgan's	$\overline{A}+\overline{B}+\overline{C}+... = \overline{ABC...}$	$\overline{A+B+C+...} = \overline{A}\ \overline{B}\ \overline{C}...$
Absorption 1 (Covering)	$A+AB = A$	$A(A+B) = A$
Absorption 2	$A+\overline{A}B = A+B$	$A(\overline{A}+B) = AB$
Involution (or double negation)	$\overline{\overline{A}} = A$	none
Distributive	$A+BC = (A+B)(A+C)$	$A(B+C) = AB+AC$
Combining	$AB+A\overline{B} = A$	$(A+B)(A+\overline{B}) = A$
Consensus	$AB+\overline{A}C+BC = AB+\overline{A}C$	$(A+B)(\overline{A}+C)(B+C) = (A+B)(\overline{A}+C)$