

10420 CS410001 – Computer Architecture 2016

Appendix A for Projects

Datasheet for the Reduced MIPS R3000 ISA

Table 1: R-Type Instructions

R	³¹ ₂₆ opcode(6)	²⁵ ₂₁ rs(5)	²⁰ ₁₆ rt(5)	¹⁵ ₁₁ rd(5)	¹⁰ ₆ C(shamt)(5)	⁵ ₀ funct(6)	Syntax	Semantic
add	0x00				x	0x20	add \$d,\$s,\$t	\$d = \$s + \$t
addu	0x00				x	0x21	add \$d,\$s,\$t	\$d = \$s + \$t(unsigned, no overflow exception)
sub	0x00				x	0x22	sub \$d,\$s,\$t	\$d = \$s - \$t
and	0x00				x	0x24	and \$d,\$s,\$t	\$d = \$s & \$t
or	0x00				x	0x25	or \$d,\$s,\$t	\$d = \$s \$t
xor	0x00				x	0x26	xor \$d,\$s,\$t	\$d = \$s ^ \$t
nor	0x00				x	0x27	nor \$d,\$s,\$t	\$d = ~ (\$s \$t)
nand	0x00				x	0x28	nand \$d,\$s,\$t	\$d = ~(\$s & \$t)
slt	0x00				x	0x2A	slt \$d,\$s,\$t	\$d = (\$s < \$t), signed comparison
sll	0x00	x				0x00	sll \$d,\$t,C	\$d = \$t << C
srl	0x00	x				0x02	srl \$d,\$t,C	\$d = \$t >> C
sra	0x00	x				0x03	sra \$d,\$t,C	\$d = \$t >> C, with sign bit shifted in
jr	0x00		x	x	x	0x08	jr \$s	PC=\$s

Table 2: I-Type Instructions

I	³¹ ₂₆ opcode(6)	²⁵ ₂₁ rs(5)	²⁰ ₁₆ rt(5)	¹⁵ ₀ C(immediate)(16)	Syntax	Semantic
addi	0x08				addi \$t,\$s,C	\$t = \$s + C(signed)
addiu	0x09				addi \$t,\$s,C	\$t = \$s + C(unsigned, no overflow exception)
lw	0x23				lw \$t,C(\$s)	\$t = 4 bytes from Memory[\$s + C(signed)]

I	³¹ opcode(6)	²⁶ rs(5)	²⁵ rt(5)	²⁰ C(immediate)(16)	¹⁵ 0	Syntax	Semantic
lh	0x21					lh \$t,C(\$s)	\$t = 2 bytes from Memory[\$s + C(signed)], signed
lhu	0x25					lhu \$t,C(\$s)	\$t = 2 bytes from Memory[\$s + C(signed)], unsigned
lb	0x20					lb \$t,C(\$s)	\$t = Memory[\$s + C(signed)], signed
lbu	0x24					lbu \$t,C(\$s)	\$t = Memory[\$s + C(signed)], unsigned
sw	0x2B					sw \$t,C(\$s)	4 bytes from Memory[\$s + C(signed)] = \$t
sh	0x29					sh \$t,C(\$s)	2 bytes from Memory[\$s + C(signed)] = \$t & 0x0000FFFF
sb	0x28					sb \$t,C(\$s)	Memory[\$s + C(signed)] = \$t & 0x000000FF
lui	0x0F	x				lui \$t,C	\$t = C << 16
andi	0x0C					andi \$t,\$s,C	\$t = \$s & C(unsigned)
ori	0x0D					ori \$t,\$s,C	\$t = \$s C(unsigned)
nori	0x0E					nori \$t,\$s,C	\$t = ~(\$s C(unsigned))
slti	0x0A					slti \$t,\$s,C	\$t = (\$s < C(signed)), signed comparison
beq	0x04					beq \$s,\$t,C	if (\$s == \$t) go to PC+4+4*C(signed)
bne	0x05					bne \$s,\$t,C	if (\$s != \$t) go to PC+4+4*C(signed)
bgtz	0x07		x			bgtz \$s,C	if (\$s > 0) go to PC+4+4*C(signed)

Table 3: J-Type Instructions

J	³¹ opcode(6)	²⁶ C(address)(26)	²⁵ 0	Syntax	Semantic
j	0x02			j C	PC = (PC+4)[31:28] 4*C(unsigned)
jal	0x03			jal C	\$31 = PC + 4; PC = (PC+4)[31:28] 4*C(unsigned)

Table 4: Specialized Instruction (to Terminate Simulation)

S	³¹ opcode(6)	²⁶ C(address)(26)	²⁵ 0	Syntax	Semantic
halt	0x3F	x		halt	halt the simulation