

# 10320 CS410001 – Computer Architecture 2015

## Appendix A for Projects

### Datasheet for the Reduced MIPS R3000 ISA

Table 1: R-Type Instructions

R	31 opcode(6)	26 rs(5)	25 rt(5)	20 rd(5)	15 C(shamt)(5)	10 6 5 0 func(6)	Syntax	Semantic
add	0x00				x	0x20	add \$d,\$s,\$t	\$d = \$s + \$t
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 opcode(6)	26 rs(5)	25 rt(5)	20 16 15 C(immediate)(16)	0	Syntax	Semantic
addi	0x08					addi \$t,\$s,C	\$t = \$s + C(signed)
lw	0x23					lw \$t,C(\$s)	\$t = 4 bytes from Memory[\$s + C(signed)]
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

I	31 opcode(6) 26	25 rs(5) 21	20 rt(5) 16	15 C(immediate)(16) 0	Syntax	Semantic
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)

Table 3: J-Type Instructions

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