MIPS reference card

add	rd, rs, rt	Add	rd = rs + rt	R 0 / 20
sub	rd, rs, rt	Subtract	rd = rs − rt	R 0 / 22
addi	rt, rs, imm	Add Imm.	rt = rs + imm$_\pm$	I 8
addu	rd, rs, rt	Add Unsigned	rd = rs + rt	R 0 / 21
subu	rd, rs, rt	Subtract Unsigned	rd = rs − rt	R 0 / 23
addiu	rt, rs, imm	Add Imm. Unsigned	rt = rs + imm$_\pm$	I 9
mult	rs, rt	Multiply	{hi, lo} = rs * rt	R 0 / 18
div	rs, rt	Divide	lo = rs / rt; hi = rs % rt	R 0 / 1a
multu	rs, rt	Multiply Unsigned	{hi, lo} = rs * rt	R 0 / 19
divu	rs, rt	Divide Unsigned	lo = rs / rt; hi = rs % rt	R 0 / 1b
mfhi	rd	Move From Hi	rd = hi	R 0 / 10
mflo	rd	Move From Lo	rd = lo	R 0 / 12
and	rd, rs, rt	And	rd = rs & rt	R 0 / 24
or	rd, rs, rt	Or	rd = rs | rt	R 0 / 25
nor	rd, rs, rt	Nor	rd = ˜(rs | rt)	R 0 / 27
xor	rd, rs, rt	eXclusive Or	rd = rs ˆ rt	R 0 / 26
andi	rt, rs, imm	And Imm.	rt = rs & imm$_0$	I c
ori	rt, rs, imm	Or Imm.	rt = rs | imm$_0$	I d
xori	rt, rs, imm	eXclusive Or Imm.	rt = rs ˆ imm$_0$	I e
sll	rd, rt, sh	Shift Left Logical	rd = rt << sh	R 0 / 0
srl	rd, rt, sh	Shift Right Logical	rd = rt >>> sh	R 0 / 2
sra	rd, rt, sh	Shift Right Arithmetic	rd = rt >> sh	R 0 / 3
sllv	rd, rt, rs	Shift Left Logical Variable	rd = rt << rs	R 0 / 4
srlv	rd, rt, rs	Shift Right Logical Variable	rd = rt >>> rs	R 0 / 6
srav	rd, rt, rs	Shift Right Arithmetic Variable	rd = rt >> rs	R 0 / 7
slt	rd, rs, rt	Set if Less Than	rd = rs < rt ? 1 : 0	R 0 / 2a
sltu	rd, rs, rt	Set if Less Than Unsigned	rd = rs < rt ? 1 : 0	R 0 / 2b
slti	rt, rs, imm	Set if Less Than Imm.	rt = rs < imm$_\pm$? 1 : 0	I a
sltiu	rt, rs, imm	Set if Less Than Imm. Unsigned	rt = rs < imm$_\pm$? 1 : 0	I b
j	addr	Jump	PC = PC&0xF0000000 | (addr$_0$<< 2)	J 2
jal	addr	Jump And Link	$ra = PC + 8; PC = PC&0xF0000000 \| (addr$_0$<< 2)	J 3
jr	rs	Jump Register	PC = rs	R 0 / 8
jalr	rs	Jump And Link Register	$ra = PC + 8; PC = rs	R 0 / 9
beq	rt, rs, imm	Branch if Equal	if (rs == rt) PC += 4 + (imm$_\pm$<< 2)	I 4
bne	rt, rs, imm	Branch if Not Equal	if (rs != rt) PC += 4 + (imm$_\pm$<< 2)	I 5
syscall		System Call	c0_cause = 8 << 2; c0_epc = PC; PC = 0x80000080	R 0 / c
lui	rt, imm	Load Upper Imm.	rt = imm << 16	I f
lb	rt, imm(rs)	Load Byte	rt = SignExt(M$_1$[rs + imm$_\pm$])	I 20
lbu	rt, imm(rs)	Load Byte Unsigned	rt = M$_1$[rs + imm$_\pm$] & 0xFF	I 24
lh	rt, imm(rs)	Load Half	rt = SignExt(M$_2$[rs + imm$_\pm$])	I 21
lhu	rt, imm(rs)	Load Half Unsigned	rt = M$_2$[rs + imm$_\pm$] & 0xFFFF	I 25
lw	rt, imm(rs)	Load Word	rt = M$_4$[rs + imm$_\pm$]	I 23
sb	rt, imm(rs)	Store Byte	M$_1$[rs + imm$_\pm$] = rt	I 28
sh	rt, imm(rs)	Store Half	M$_2$[rs + imm$_\pm$] = rt	I 29
sw	rt, imm(rs)	Store Word	M$_4$[rs + imm$_\pm$] = rt	I 2b
ll	rt, imm(rs)	Load Linked	rt = M$_4$[rs + imm$_\pm$]	I 30
sc	rt, imm(rs)	Store Conditional	M$_4$[rs + imm$_\pm$] = rt; rt = atomic ? 1 : 0	I 38

registers

$0	$zero
$1	$at
$2–$3	$v0–$v1
$4–$7	$a0–$a3
$8–$15	$t0–$t7
$16–$23	$s0–$s7
$24–$25	$t8–$t9
$26–$27	$k0–$k1
$28	$gp
$29	$sp
$30	$fp
$31	$ra
hi	—
lo	—
PC	—
co $13	c0_cause
co $14	c0_epc

syscall codes for MARS/SPIM

1	print integer
2	print float
3	print double
4	print string
5	read integer
6	read float
7	read double
8	read string
9	sbrk/alloc. mem.
10	exit
11	print character
12	read character
13	open file
14	read file
15	write to file
16	close file

exception causes

0	interrupt
1	TLB protection
2	TLB miss L/F
3	TLB miss S
4	bad address L/F
5	bad address S
6	bus error F
7	bus error L/S
8	syscall
9	break
a	reserved instr.
b	coproc. unusable
c	arith. overflow

F: fetch instr.
L: load data
S: store data

pseudo-instructions

bge	rx, ry, imm	Branch if Greater or Equal
bgt	rx, ry, imm	Branch if Greater Than
ble	rx, ry, imm	Branch if Less or Equal
blt	rx, ry, imm	Branch if Less Than
la	rx, label	Load Address
li	rx, imm	Load Immediate
move	rx, ry	Move register
nop		No Operation

	6 bits	5 bits	5 bits	5 bits	5 bits	6 bits
R	op	rs	rt	rd	sh	func

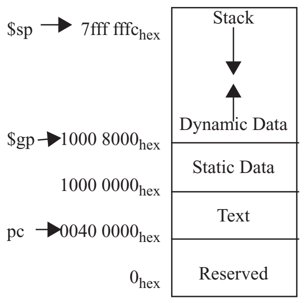
	6 bits	5 bits	5 bits	16 bits
I	op	rs	rt	imm

	6 bits	26 bits
J	op	addr

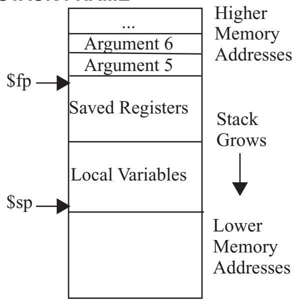
REGISTER NAME, NUMBER, USE, CALL CONVENTION

NAME	NUMBER	USE	PRESERVED ACROSS A CALL?
\$zero	0	The Constant Value 0	N.A.
\$at	1	Assembler Temporary	No
\$v0-\$v1	2-3	Values for Function Results and Expression Evaluation	No
\$a0-\$a3	4-7	Arguments	No
\$t0-\$t7	8-15	Temporaries	No
\$s0-\$s7	16-23	Saved Temporaries	Yes
\$t8-\$t9	24-25	Temporaries	No
\$k0-\$k1	26-27	Reserved for OS Kernel	No
\$gp	28	Global Pointer	Yes
\$sp	29	Stack Pointer	Yes
\$fp	30	Frame Pointer	Yes
\$ra	31	Return Address	No

MEMORY ALLOCATION



STACK FRAME


...
Argument 6
Argument 5
$fp →
Saved Registers
Local Variables
$sp →
Higher Memory Addresses
Stack Grows
Lower Memory Addresses