

Support of MIPS Assembly Instruction Set

Legend: Supported instructions - blue, Unsupported instructions (to be implemented as part of LAB5) - black

Arithmetic Instructions			
<i>Instruction</i>	<i>Example</i>	<i>Meaning</i>	<i>Comments</i>
add	add \$1,\$2,\$3	$\$1 = \$2 + \$3$	
subtract	sub \$1,\$2,\$3	$\$1 = \$2 - \$3$	
add immediate	addi \$1,\$2,100	$\$1 = \$2 + 100$	
Multiply (without overflow)	mul \$1,\$2,\$3	$\$1 = \$2 * \$3$	The destination register is only 32 bits, where for the two source registers, only the lower half word (16-bit) content matters

Logical and shift Instructions			
<i>Instruction</i>	<i>Example</i>	<i>Meaning</i>	<i>Comments</i>
and	and \$1,\$2,\$3	$\$1 = \$2 \& \$3$	Bitwise AND
or	or \$1,\$2,\$3	$\$1 = \$2 \$3$	Bitwise OR
xor	xor \$1,\$2,\$3	$\$1 = \$2 \wedge \$3$	Bitwise XOR
and immediate	andi \$1,\$2,100	$\$1 = \$2 \& 100$	Bitwise AND with immediate value
or immediate	ori \$1,\$2,100	$\$1 = \$2 100$	Bitwise OR with immediate value
xor immediate	xori \$1,\$2,100	$\$1 = \$2 \wedge 100$	Bitwise XOR with immediate value
shift left logical	sll \$1,\$2,10	$\$1 = \$2 \ll 10$	Shift left by a constant number of bits
shift right logical	srl \$1,\$2,10	$\$1 = \$2 \gg 10$	Shift right by a constant number of bits

Data Transfer Instructions			
<i>Instruction</i>	<i>Example</i>	<i>Meaning</i>	<i>Comments</i>
move	move \$1,\$2	$\$1 = \2	Pseudo-instruction (provided by MARS Assembler, not processor!) Copy from register to register.
load address	la \$1, label	$\$1 = \text{label address}$	Pseudo-instruction (provided by MARS Assembler, not processor!) Loads the computed address of a label (not its data content) into a register
load immediate	li \$1,100	$\$1 = 100$	Pseudo-instruction (provided by MARS Assembler, not processor!) Loads an immediate value into a register
load word	lw \$1,100(\$2)	$\$1 = \text{Memory}[\$2 + 100]$	
store word	sw \$1,100(\$2)	$\text{Memory}[\$2 + 100] = \1	
load upper immediate	lui \$1,100	$\$1 = 100 \times 2^{16}$	Load constant into upper 16 bits. Lower 16 bits are set to zero.

Conditional Branch Instructions			
<i>Instruction</i>	<i>Example</i>	<i>Meaning</i>	<i>Comments</i>
branch on equal	beq \$1,\$2,100	if($\$1 == \2) go to PC+4+100	Test if registers are equal
branch on not equal	bne \$1,\$2,100	if($\$1 \neq \2) go to PC+4+100	Test if registers are not equal
branch on greater or equal than	bge \$1,\$2,100	if($\$1 \geq \2) go to PC+4+100	Pseudo-instruction
branch on less than	blt \$1,\$2,100	if($\$1 < \2) go to PC+4+100	Pseudo-instruction

Comparison Instructions			
Instruction	Example	Meaning	Comments
set on less than	slt \$1,\$2,\$3	if(\$2<\$3)\$1=1; else \$1=0	Test if less than. If true, set \$1 to 1. Otherwise, set \$1 to 0.
set on less than immediate	Slti \$1,\$2,100	if(\$2<100)\$1=1; else \$1=0	Test if less than. If true, set \$1 to 1. Otherwise, set \$1 to 0.

Unconditional Jump Instructions			
Instruction	Example	Meaning	Comments
jump	j 1000	go to address 1000	Jump to target address
jump register	jr \$ra	go to return address stored in \$ra	For switch, procedure return
jump and link	jal 1000	1. Save the procedure return address \$ra=PC+4 2. Go to a procedure call address, which starts at address 1000	Use when making procedure call. This saves the return address in \$ra