Reduced MIPS ISA

Storage space

In this exercise, MIPS uses

- 4 Gigabytes (2^{32} bytes) of memory
- A register file of 32 registers of 32 bits each. They are called $0, $1, up to $31. $0 always contains a 0 and cannot be changed.

Reduced instruction set description

Transfer instructions			
Instruction	Mnemonic	Operation	Example
Load word	lw rt, offset(rs)	rt ← mem[rs + offset]	lw $5, 32($0) $5 ← mem[32+0]
Store word	sw rt, offset(rs)	mem[rs + offset] ← rt	sw $4, 16($2) mem[16+$2] ← x4
Arithmetical-logical instructions			
Instruction	Mnemonic	Operation	Example
Add Immediate	addi rt, rs, imm	rt ← rs + imm	addi $5, $2, -15 $5 ← $2 + (-15)
Add	add rd, rs, rt	rd ← rs + rt	add $2, $3, $4 $2 ← $3 + $4
Subtract	sub rd, rs, rt	rd ← rs - rt	sub $4, $5, $6 $4 ← $5 - $6
And Immediate	andi rt, rs, imm	rt ← rs ∧ imm	andi $5, $2, 2 $5 ← $2 ∧ 2
And	and rd, rs, rt	rd ← rs ∧ rt	and $2, $3, $4 $2 ← $3 ∧ $4
Or Immediate	ori rt, rs, imm	rt ← rs ∨ imm	ori $5, $2, 2 $5 ← $2 ∨ 2
Or	or rd, rs, rt	rd ← rs ∨ rt	or $2, $3, $4 $2 ← $3 ∨ $4
Shift Left Logical	sll rd, rt, imm	rd ← rt ≪ imm	sll $2, $3, 2 $2 ← $3 ≪ 2
Shift Right Logical	srl rd, rt, imm	rd ← rt ≫ imm	srl $2, $3, 2 $2 ← $3 ≫ 2

Control instructions			
Instruction	Mnemonic	Operation	Example

Branch Equal	beq rs, rt, label	if rs = rt then
		pc ← label
			beq $1, $0, loop

Branch Not Equal	bne rs, rt, label	if rs != rt then
		pc ← label
			bne $1, $0, loop

Jump	j label	pc ← label	j loop
Jump and Link	jal label	$31 ← pc + length inst. pc ← label	jal loop
Jump Register	jr rs	pc ← rs	jr $31

Exercise

Given a list of common actions in assembly programming. Give for each action (a list of) instruction which would make it work. Describe the operands that are used.

Load a specific number into a register → Load 5 into register 5
Move the content of one register to another → Move the content of register 0 to register 6
Load a memory position content into a register → Load the content of memory position 64 into register 4
Store a register content into a specific memory position → Store the content of register 3 in memory position 32