

## Instruction Set

- Arithmetic and logic instructions
- **Memory access instructions**
- Control instructions
- System instructions



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December 2008

## Instruction Set

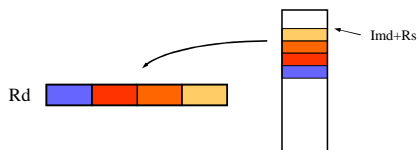
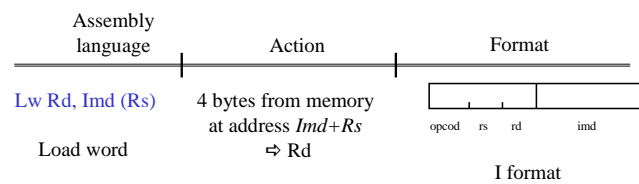
- Loads
- Stores



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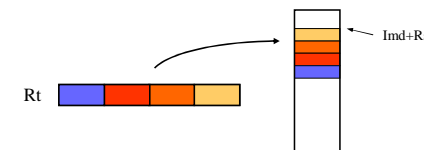
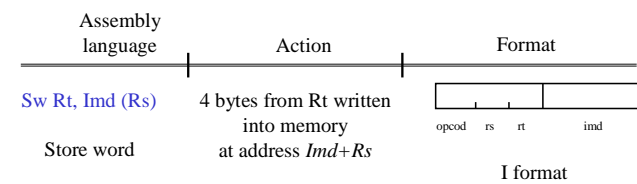
## Memory access



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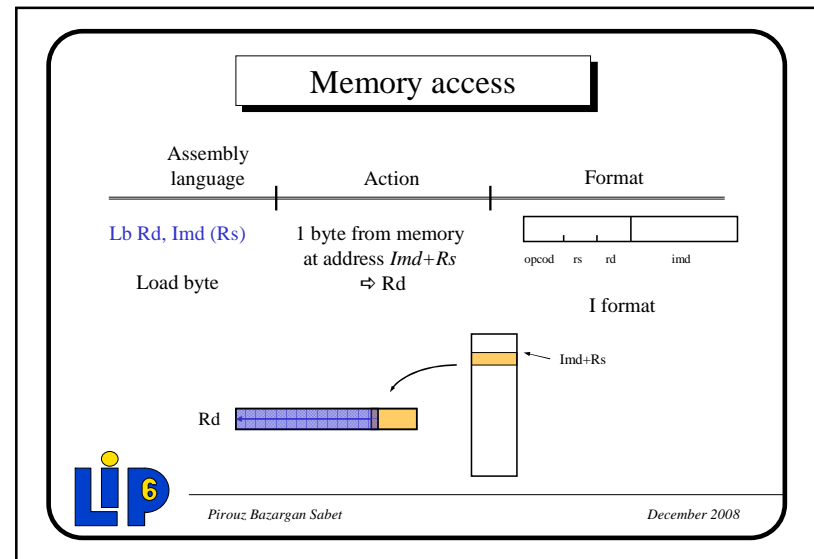
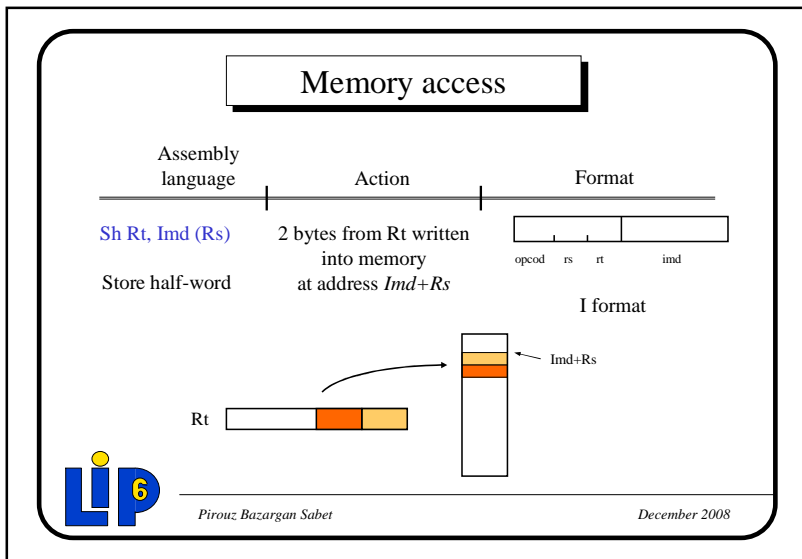
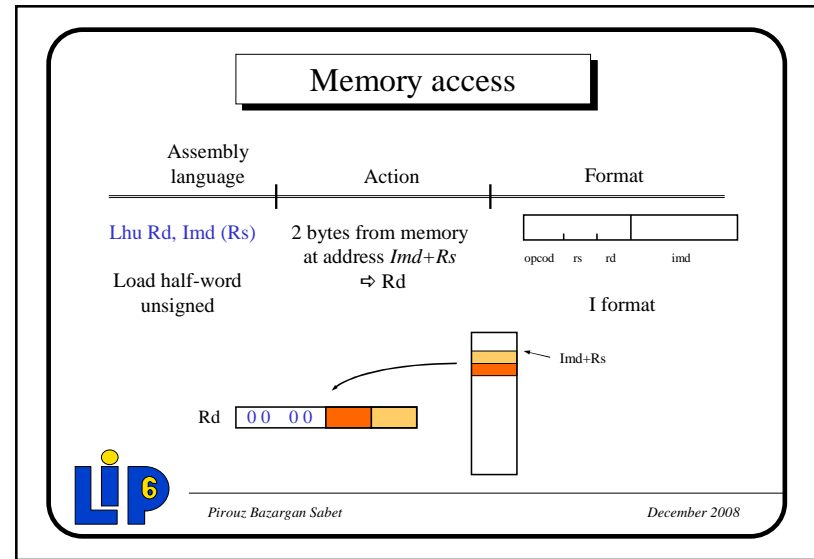
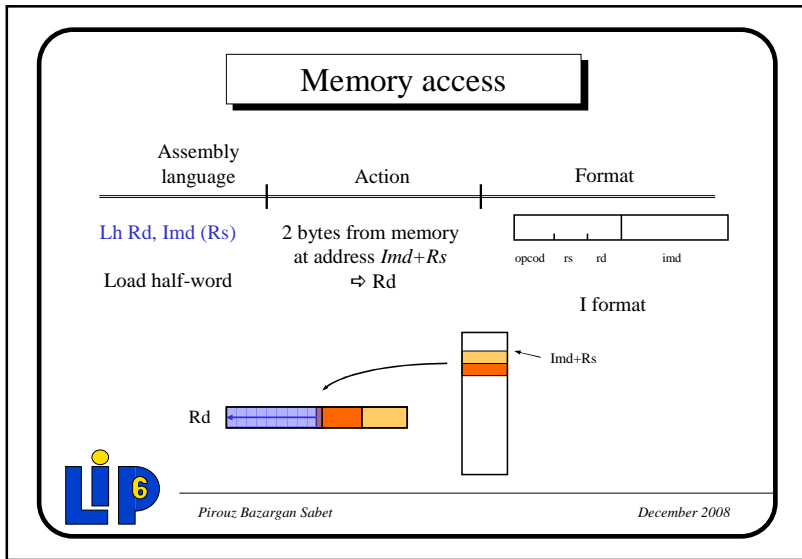
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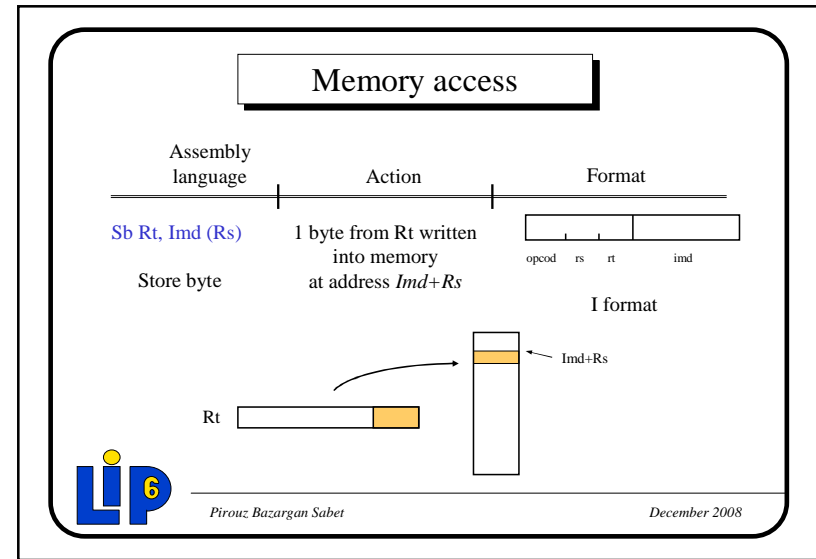
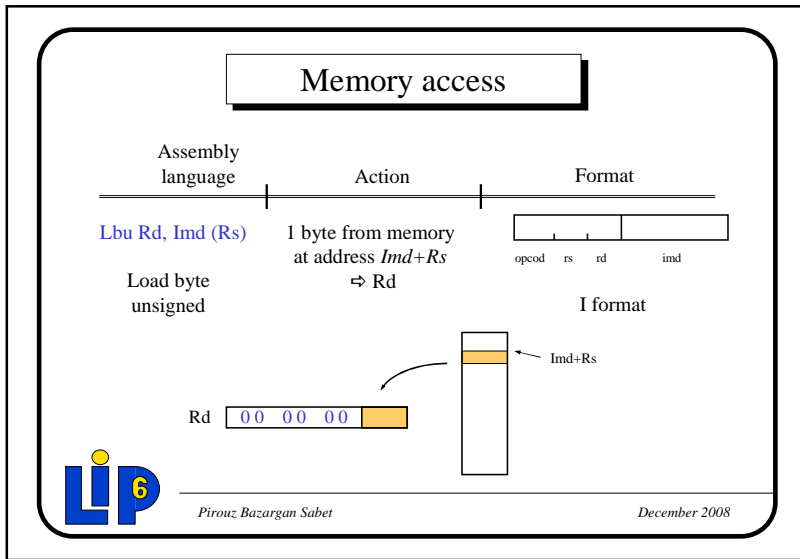
## Memory access





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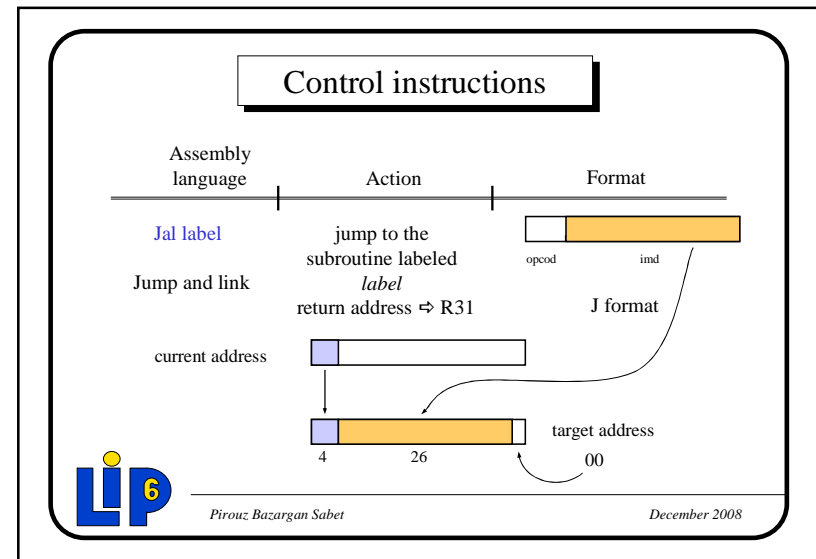
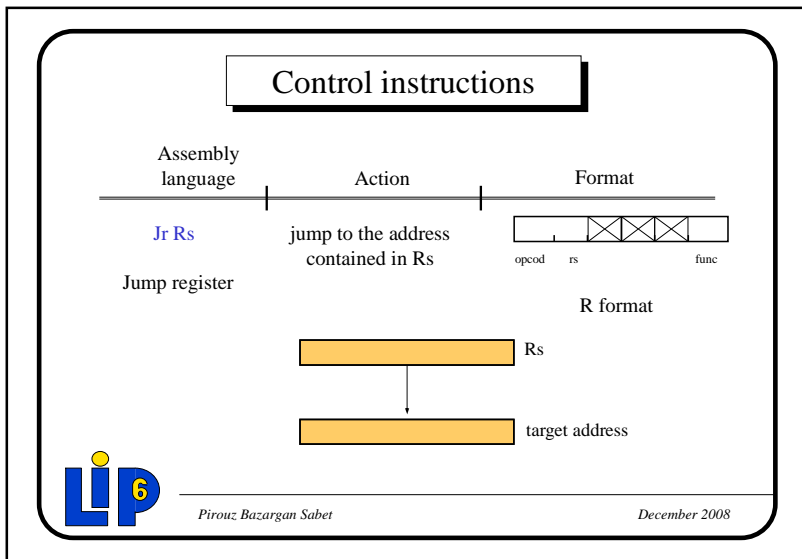
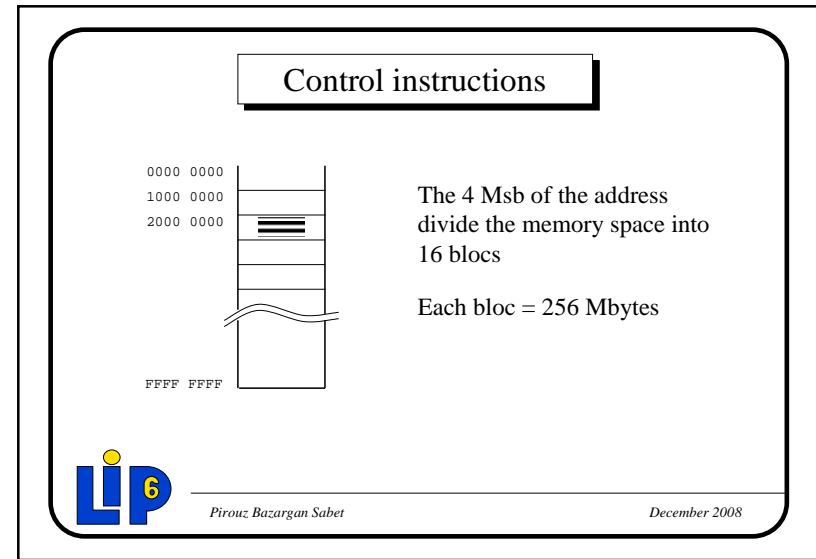
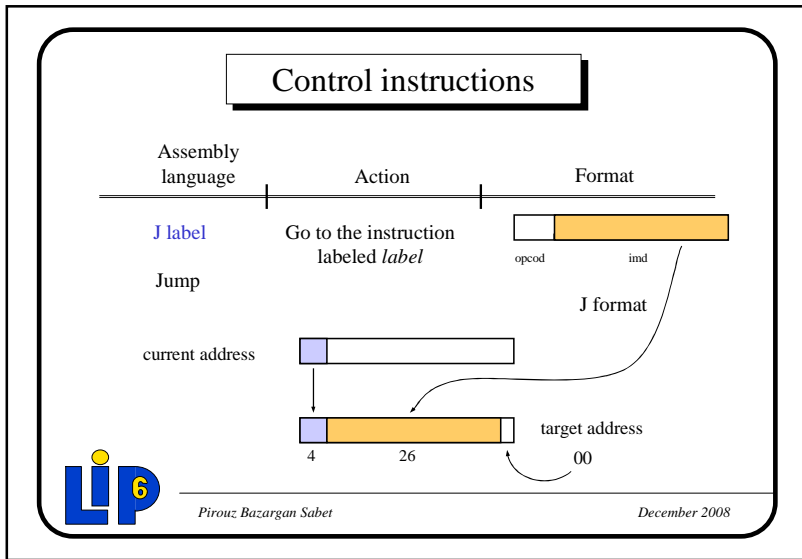
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- ### Instruction Set
- Arithmetic and logic instructions
  - Memory access instructions
  - Control instructions**
  - System instructions
- 
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- ### Control instructions
- Unconditional branches (jumps)**
  - Conditional branches
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### Control instructions

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Func : \_\_\_\_\_

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### Control instructions

Assembly language	Action	Format
Jalr Rs	jump to the address contained in Rs	
Jump and link register	return address ⇒ R31	R format

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### Control instructions

- Unconditional branches (jumps)
- Conditional branches

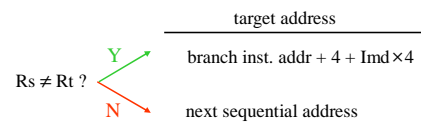
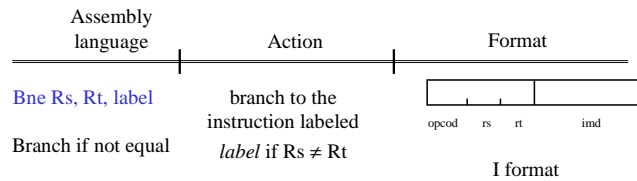
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### Control instructions

Assembly language	Action	Format
Beq Rs, Rt, label	branch to the instruction labeled label if Rs = Rt	
Branch if equal		I format
	<p style="text-align: center;">target address</p> <p>Rs = Rt ?</p> <div style="display: flex; justify-content: center; gap: 20px;"> <div style="text-align: center;"> <p style="color: green;">Y</p> <p style="color: red;">N</p> </div> <div style="text-align: center;"> <p>branch inst. addr + 4 + Imd × 4</p> <p>next sequential address</p> </div> </div>	

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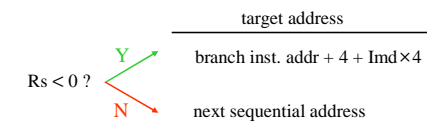
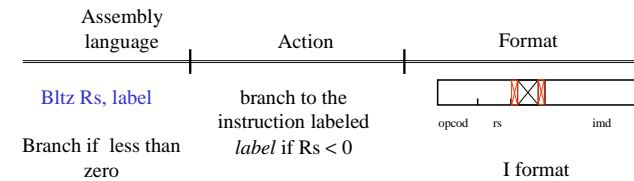
## Control instructions



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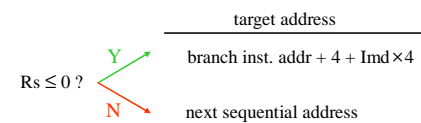
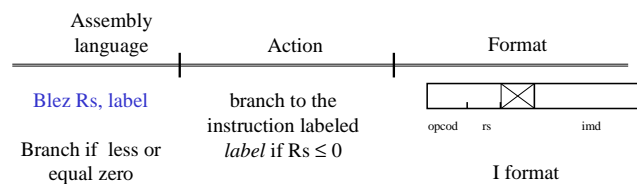
## Control instructions



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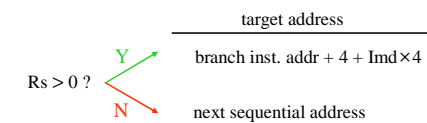
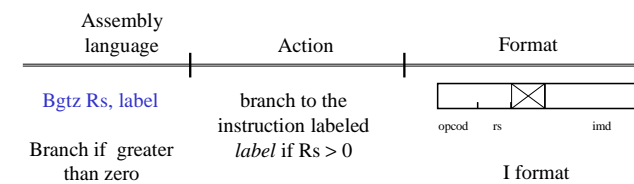
## Control instructions



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## Control instructions

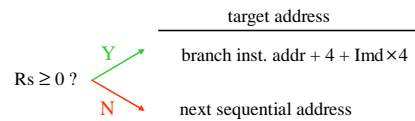


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## Control instructions


Assembly language	Action	Format
<b>Bgez Rs, label</b> Branch if greater or equal zero	branch to the instruction labeled <i>label</i> if $R_s \geq 0$	 I format

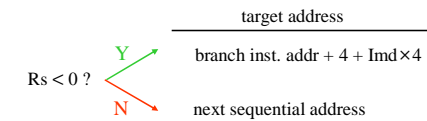


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## Control instructions

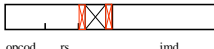
Assembly language	Action	Format
<b>Bltzal Rs, label</b> Branch if less than zero and link	branch to the instruction labeled <i>label</i> if $R_s < 0$ return address $\Rightarrow R31$	 I format

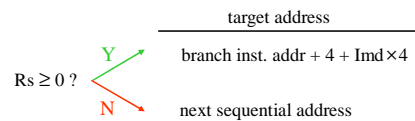


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## Control instructions

Assembly language	Action	Format
<b>Bgezal Rs, label</b> Branch if greater or equal zero and link	branch to the instruction labeled <i>label</i> if $R_s \geq 0$ return address $\Rightarrow R31$	 I format



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### System instructions

Assembly language	Action	Format
<p><b>Syscall</b></p> <p>System Call</p>	<p>Call a service of the operating system</p> <p>Stop executing the current program and jump to the Exception Handler</p>	<div style="text-align: center;"> </div> <p style="text-align: center;">R format</p>

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### System instructions

Assembly language	Action	Format
<p><b>Break n</b></p> <p>Break</p>	<p>Call the debugger through the operating system</p> <p>Stop executing the current program and jump to the Exception Handler</p>	<div style="text-align: center;"> </div> <p style="text-align: center;">R format</p>

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### System instructions

Assembly language	Action	Format
<p><b>Rfe</b></p> <p>Restore from exception</p>	<p>Restore the previous state of the status register</p> <p>Exc if executed in User mode</p>	<div style="text-align: center;"> </div> <p style="text-align: center;">I format</p> <p style="font-size: x-small;">Bits # 25 and 0 to 4 used to extend the opcode</p>

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### System instructions

Assembly language	Action	Format
<p><b>Mfc0 Rd, S</b></p> <p>Move from coprocessor 0</p>	<p>Move a special register into an integer register</p> <p>Exc if executed in User mode</p>	<div style="text-align: center;"> </div> <p style="text-align: center;">I format</p> <p style="font-size: x-small;">Bits # 21 to 25 used to extend the opcode</p>

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## System instructions

Assembly language	Action	Format
<p><b>Mtc0 Rt, S</b></p> <p>Move to coprocessor 0</p>	<p>Move an integer register into a special register</p> <p><b>Exc if executed in User mode</b></p>	<div style="display: flex; align-items: center; gap: 5px;"> <div style="border: 1px solid black; width: 20px; height: 15px; position: relative;"> <span style="position: absolute; top: -5px; left: -5px; font-size: 8px;">opcod</span> <span style="position: absolute; top: -5px; left: 15px; font-size: 8px;">rs</span> <span style="position: absolute; top: -5px; left: 30px; font-size: 8px;">rt</span> <span style="position: absolute; top: -5px; left: 45px; font-size: 8px;">s</span> </div> <div style="border: 1px solid black; width: 20px; height: 15px; position: relative;"> <span style="position: absolute; top: -5px; left: -5px; font-size: 8px;">opcod</span> <span style="position: absolute; top: -5px; left: 15px; font-size: 8px;">rs</span> <span style="position: absolute; top: -5px; left: 30px; font-size: 8px;">rt</span> <span style="position: absolute; top: -5px; left: 45px; font-size: 8px;">s</span> </div> </div> <p>I format</p> <p>Bits # 21 to 25 used to extend the opcod</p>



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