

Controller Instructions and their control signals:
I-type:

| Instruc tions | Mem Read | Mem Write | Mem To Reg | ALUSrc | ALUOp | RegWrite | RegDst | Branch | J | Jr | Write Link | R31 | Opcode |
|------------------|-------------|--------------|------------------|--------|-------|----------|--------|--------|---|----|---------------|-----|--------|
| addi | - | 0 | 0 | 1 | 00 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 001000 |
| slti | - | 0 | 0 | 1 | 11 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 001010 |
| lw | 1 | 0 | 1 | 1 | 00 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 100011 |
| sw | - | 1 | 0 | 1 | 00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 101011 |
| beq | - | 0 | - | 0 | 01 | 0 | - | 1 | 0 | 0 | 0 | 0 | 000100 |
| jr | - | 0 | 0 | 0 | - | 0 | - | 0 | 1 | 1 | 0 | 0 | 100000 |

R-type (Opcode = 000000):

| Instruc tions | Mem Read | Mem Write | Mem To Reg | ALUSrc | ALUOp | Reg Write | RegDst | Branch | J | Jr | Write Link | R31 | function |
|------------------|-------------|--------------|------------------|--------|-------|--------------|--------|--------|---|----|---------------|-----|----------|
| add | - | 0 | 0 | 0 | 10 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 100000 |
| sub | - | 0 | 0 | 0 | 10 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 100010 |
| and | - | 0 | 0 | 0 | 10 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 100001 |
| or | - | 0 | 0 | 0 | 10 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 100101 |
| slt | - | 0 | 0 | 0 | 10 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 101010 |

J-type:

| Instruc tions | Mem Read | Mem Write | MemTo Reg | ALUSrc | ALUOp | RegWrite | RegDst | Branch | J | Jr | Write Link | R31 | Opcode |
|------------------|-------------|--------------|--------------|--------|-------|----------|--------|--------|---|----|---------------|-----|--------|
| j | - | 0 | - | 1 | - | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 000010 |
| jal | - | 0 | - | 1 | - | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 000011 |