Instruction forma(16-bit):
R-type:

| Opcode(4-bit) | Rs(4-bit) | Rt(4-bit) | Rd(4-bit) |
|---|---|---|---|

I-type:

| Opcode(4-bit) | Rs(4-bit) | Rt(4-bit) | Imm/Address/Offset (4-bit) |
|---|---|---|---|

Instructions and Opcodes:

| Instruction | Op Code | format |
|---|---|---|
| add | 0000 | R |
| sub | 0001 | R |
| mul | 0010 | R |
| div | 0011 | R |
| ori | 0100 | I |
| nor | 0101 | R |
| nand | 0110 | R |
| sw | 0111 | I |
| lw | 1000 | I |
| blt | 1001 | I |

Control Unit Truth Table:

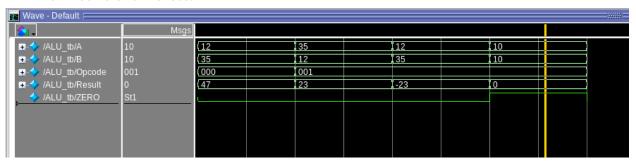| | R-format | ori | sw | lw | blt |
|---|---|---|---|---|---|
| RegDst | 1 | 0 | X | 0 | X |
| Alusrc | 0 | 1 | 1 | 1 | 0 |
| MemToReg | 0 | 0 | X | 1 | X |
| RegWrite | 1 | 1 | 0 | 1 | 0 |
| MemWrite | 0 | 0 | 1 | 0 | 0 |
| Branch | 0 | 0 | 0 | 0 | 1 |
| ExtOp | X | 0 | 1 | 1 | 0 |
| Aluctr | Op[2:0] | Op[2:0] | 000 | Op[2:0] | Op[2:0] |

add, sub, mul, div, nor and nand are the same but with different Opcodes.
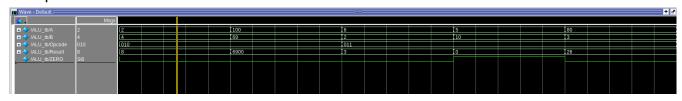
## Control Unit test results:



## ALU test results:

### Adder and subtractor tests:



### Multiplier and Subtractor tests:



### OR, NOR and NAND tests: