**Main control Truth Table:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Opcode | RegDes | RegWr | RegWr2 | | ExtOp | | ALUSrc | | Mem\_Rd | | Mem\_Wr | | WB\_data | | PushSig | PopSig | StackOp |
| R-type | 1 🡪 Rd | 1 | 0 | | X | | 0 | | 0 | | 0 | | 0 = ALU | | X | X | X |
| ANDI | 0 🡪 Rs2 | 1 | 0 | | 0 🡪 zero | | 1 🡪 imm | | 0 | | 0 | | 0 = ALU | | X | X | X |
| ADDI | 0 🡪 Rs2 | 1 | 0 | | 1 🡪 sign | | 1 🡪 imm | | 0 | | 0 | | 0 = ALU | | X | X | X |
| LW | 0 🡪 Rs2 | 1 | 0 | | 1 🡪 sign | | 1 🡪 imm | | 1 | | 0 | | 1 = Mem | | X | X | X |
| LW.POI | 0 🡪 Rs2 | 1 | 1 | | 1 🡪 sign | | 1 🡪 imm | | 1 | | 0 | | 1 = Mem | | X | X | X |
| SW | X | 0 | 0 | | 1 🡪 sign | | 1 🡪 imm | | 0 | | 1 | | X | | X | X | X |
| BGT | X | 0 | 0 | | 1 🡪 sign | | 0 🡪 BusB | | 0 | | 0 | | X | | X | X | X |
| BLT | X | 0 | 0 | | 1 🡪 sign | | 0 🡪 BusB | | 0 | | 0 | | X | | X | X | X |
| BEQ | X | 1 | | 0 | | 1 🡪 sign | | 0 🡪 BusB | | 0 | | 0 | X | | x | X | X |
| BNQ | X | 1 | | 0 | | 1 🡪 sign | | 0 🡪 BusB | | 0 | | 0 | | X | X | X | X |
| JMP | X | X | | 0 | | X | | X | | 0 | | 0 | | X | x | x | X |
| CALL | X | X | | 0 | | X | | X | | 0 | | 0 | | X | 1 | 0 | 1 |
| RET | X | X | | 0 | | X | | X | | 0 | | 0 | | X | 0 | 1 | 1 |
| PUSH | X | 1 | | 0 | | X | | X | | 0 | | 0 | | X | 1 | 0 | 0 |
| POP | 1 | X | | 0 | | X | | X | | 0 | | 0 | | X | 0 | 1 | 0 |

**PC Truth Table :**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Opcode | Zero flag | Over flow flag | Negative flag | PCSrc |
| R type | X | x | X | 0 |
| JMP | X | X | x | 1 |
| CALL | X | x | X | 1 |
| RET | x | x | X | 3 |
| BGT | 1 | x | X | 0 |
| BGT | 0 | 1 | x | 2 |
| BGT | 0 | 0 | 1 | 0 |
| BLT | 1 | x | X | 0 |
| BLT | 0 | 1 | x | 0 |
| BLT | 0 | 0 | 1 | 2 |
| BNE | 0 | x | X | 2 |
| BNE | 1 | x | x | 0 |
| BEQ | 0 | x | X | 0 |
| BEQ | 1 | x | x | 2 |
| Other that J or B | x | x | x | 0 |

**ALU Truth Table:**

|  |  |  |  |
| --- | --- | --- | --- |
| **OPcode** | **function** | **ALUOp** | **4 bit coding** |
| R-type | AND | AND | 0001 |
| R-type | ADD | ADD | 0010 |
| R-type | SUB | SUB | 0011 |
| ANDI | X | AND | 0001 |
| ADDI | X | ADD | 0010 |
| LW | X | ADD | 0010 |
| LW.POI | x | ADD | 0010 |
| SW | X | ADD | 0010 |
| BGT | X | SUB | 0100 |
| BLT | X | SUB | 0100 |
| BEQ | X | SUB | 0100 |
| BNE | X | SUB | 0100 |
| JMP | X | X | X |
| CALL | X | X | X |
| RET | X | X | X |
| PUSH | X | x | X |
| POP | X | x | x |

**Main Control Signals:**

|  |  |  |
| --- | --- | --- |
| **Signal** | **Effect when 0** | **Effect when 1** |
| **RegDs** |  |  |
| **RagWr** |  |  |
| **RagWr2** |  |  |
| **ExtOp** |  |  |
| **ALUSrc** |  |  |
| **Mem\_Wr** |  |  |
| **Mem\_Rd** |  |  |
| **WBdata** |  |  |
| **PushSig** |  |  |
| **PopSig** |  |  |
| **StackOp** |  |  |

|  |  |  |
| --- | --- | --- |
| **Signal** | **value** | **Effect** |
| **PcSrc** | **0** |  |
| **1** |  |
| **2** |  |
| **3** |  |