|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **VARIABLE** | **STAGE1** | **STAGE2** | **STAGE3** | **STAGE4** |
| **FETCH()** | **Wire [31:0] current\_pc;** | **Wire [31:0] inst;**  **Current\_pc = PC.read();**  **Inst=IMAU.read(current\_pc);**  **Null=IR.written(inst;**  **Null=PC.inc();** |  |  |  |
| **GPR2READ****(arg1, arg2)** | **Wire [31:0] source0;**  **Wire [31:0] source1;** | **Source0=GPR.read0(arg1);**  **Source1=GPR.read1(arg2);** |  |  |  |
| **GPR1READ1EXT(arg1, arg2)** | **Wire [31:0] source0;**  **Wire [31:0] source1;** | **Source0=GPR.read0(arg1);**  **Source1=EXT0.sign(arg2);** |  |  |  |
| **GPR1READ1CONST****(arg1, arg2)** | **Wire [31:0] source0;**  **Wire [31:0] source1;** | **Wire [15:0] zero\_16;**  **Source0=GPR.read0(arg1);**  **Zero\_16 = 0000**  **Source1=<zero\_16,arg2>;** |  |  |  |
| **SHIFT****(ope, src1, src2)** | **Wire [31:0] result;** | **Wire [4:0] shamt;**  **Shamt=src2[4:0];**  **Result=SFT0.ope(src1,shamt);** |  |  |  |
| **WRITEBACK(****arg1, arg2)** |  | **Null=GPR.write0(arg1,arg2);** |  |  |  |
| **JUMP()** | **Wire [31:0] target;** | **Target=GPR.read0(rs0);** | **Null=PC.write(target);** |  |  |
| **WRITELINKREG()** | **Wire [31:0] link;** | **Link=PC.read();** |  |  | **Wire [4:0] reg\_num;**  **Reg\_num = “11111”;**  **Null=GPR.write0(reg\_num,link);** |
| **MUL****(ope, arg1, arg2)** | **Wire [31:0] result;** | **Wire [63:0] tem\_result;**  **Temp\_result=MUL0.ope(arg1,arg2);**  **Result=  tmp\_result[31:0];** |  |  |  |
| **DIVIDE(ope, arg1, arg2)** | **Wire [31:0] result;**  **Wire [31:0] mod\_result;** | **Wire div\_flag;**  **<result, mod\_result,div\_flag>=DIV0.ope(arg1,arg2);** |  |  |  |
| **ALUEXEC(ope, arg1, arg2)** | **Wire [31:0] result;** | **Wire [3:0] flag;**  **<result, flag>=ALU0.ope(arg1,arg2);** |  |  |  |
| **COMP()** | **Wire [3:0] flag;** | **Flag=ALU0.cmp(source0,source1);** |  | **Wire [2:0] tmp\_flag;**  **Wire cond1,cond2,cond3,cond4;**  **Wire cond;**  **Wire [30:0] zero31;**  **Wire [31:0] result;**  **Wire [2:0] tmp\_flag1;**  **Wire tmp\_flag2;**  **Wire [1:0] tmp\_flag3;**  **Wire [2:0] tmp\_flag4;**  **Zero31=000..00** |  |
| **JUMPADDR()** | **Wire [31:0] offset;** | **Wire [1:0] zero2;**  **Wire [27:0] ext\_const;**  **Wire [31:0] tmp\_offset;**  **Wire [1:0] first;**  **Wire [29:0] second;**  **Zero2=00**  **Ext\_const=<const,zero2>**  **Temp\_offset=EXT1.sign(ext\_const);**  **First=tmp\_offset[31:30];**  **second=tmp\_offset[31:2];**  **offset=<first,second>** | **Wire [31:0] target;**  **Wire [3:0] flag;**  **<target,flag>=ALU0.add(current\_pc,offset);**  **Null=PC.write(target);** |  |  |
| **BRANCH(ope)** | **Wire [31:0] offset;**  **Wire [31:0] source0;** | **Source0=GPR.read(rs0);**  **Offset=EXT0.sign(const)** | **Wire cond;**  **Wire [31:0] target;**  **Wire [3:0] flag;**  **Cond = source0 ope “000..000”**  **<target,flag>=ALU0.add(current\_pc,offset);**  **Null=[cond]PC.write(target);** |  |  |
| **LOAD(ope)** | **Wire [31:0] addr;**  **Wire [31:0] result;** | **Wire [3:0] flag;**  **<addr,flag>=ALU0.add(source0,source1);** | **Wire addr\_errr;**  **<result,addr\_err>=DMAU.ope(addr);** | **Null=GPR.write0(rd,result);** |  |
| **STORE(ope)** | **Wire [31:0] data; base, offset, addr:** | **Data=GPR.read0(rd)**  **base=GPR.read1(rs0)**  **offset=EXT0.sign(const);** | **Wire [3:0] flag;**  **<addr,flag>=ALU0.add(base,offset);** | **Wire addr\_err;**  **addr\_err=DMAU.ope(addr,data);** |  |
| **EQ()** | **Wire [3:0] flag;** | **Flag=ALU0.cmp(sourc0,source1);** |  | **Wire coond;**  **Wire [30:0] zero31;**  **Wire [31:0] result;**  **Zero31=00..000**  **Cond=flag==”1100”;**  **Result <zero31,cond>**  **Null=GPR.write0(rd,result);** |  |
| **NE()** | **Wire [3:0] flag;** | **Flag=ALU0.cmp(sourc0,source1);** |  | **Wire cond;**  **Wire [30:0] zero31;**  **Wire [31:0] result;**  **Zero31=00..000**  **Cond=flag!=”1100”;**  **Result <zero31,cond>**  **Null=GPR.write0(rd,result);** |  |
| **MODULO(ope, arg1, arg2)** | **Wire [31:0] result;**  **Wire [31:0] div\_result;** | **Wire div\_flag;**  **<div\_result,result,div\_flag>=DIV0.ope(arg1,arg2);** |  |  |  |
| **LT(ope)** | **Wire [3:0] flag;** | **Flag=ALU0.ope(sourc0,source1);** |  | **Wire [2:0] tmp\_flag;**  **Wire cond, conod1, cond2;**  **Wire [30:0] zero31;**  **Wire [31:0] result;**  **Zero31=00..000**  **Tmp\_flag=flag[2:0];**  **Cond1= temp\_flag ==010**  **Cond2= flag ==1001**  **Cond=cond1 | cond2;**  **Result <zero31,cond>**  **Null=GPR.write0(rd,result);** |  |
|  |  |  |  |  |  |
| **GT(ope)** | **Wire [3:0] flag;** | **Flag=ALU0.ope(sourc0,source1);** |  | **Wire [2:0] tmp\_flag;**  **Wire cond, conod1, cond2;**  **Wire [30:0] zero31;**  **Wire [31:0] result;**  **Zero31=00..000**  **Tmp\_flag=flag[2:0];**  **Cond1= temp\_flag ==000**  **Cond2= flag ==0011**  **Cond=cond1 | cond2;**  **Result <zero31,cond>**  **Null=GPR.write0(rd,result);** |  |
| **LE(ope)** | **Wire [3:0] flag;** | **Flag=ALU0.ope(sourc0,source1);** |  | **Wire [2:0] tmp\_flag;**  **Wire cond, conod1, cond2;**  **Wire coond3, cond4;**  **Wire [30:0] zero31;**  **Wire [31:0] result;**  **Zero31=00..000**  **Tmp\_flag=flag[2:0];**  **Cond1= temp\_flag ==010**  **Cond2= flag ==1001**  **Cond3= flag ==1100**  **Cond4=cond1 | cond2;**  **Cond=cond3 | cond4;**  **Result <zero31,cond>**  **Null=GPR.write0(rd,result);** |  |
| **GE(ope)** | **Wire [3:0] flag;** | **Flag=ALU0.ope(sourc0,source1);** |  | **Wire cond, conod1, cond2;**  **Wire coond3, cond4;**  **Wire [30:0] zero31;**  **Wire [31:0] result;**  **Wire [2:0] tmp\_flag1;**  **Wire [2:0] tmp\_flag4;**  **Wire [1:0] tmp\_flag3;**  **Wire tmp\_flag2;**  **Zero31=00..000**  **Tmp\_flag1=flag[2:0];**  **Tmp\_flag2=flag[3];**  **Tmp\_flag3=flag[1:0];**  **Tmp\_flag4=<****tmp\_flag2, tmp\_flag3>;**  **Cond1= temp\_flag1 ==000**  **Cond2= tmp\_flag ==100**  **Cond3= flag ==0011**  **Cond4=cond1 | cond2;**  **Cond=cond3 | cond4;**  **Result <zero31,cond>**  **Null=GPR.write0(rd,result);** |  |