EE-337 PROJECT-1
MULTI-CYCLE RISC

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1. ADD

111 → rf-a1 rf-d1 → Mem-a,alu Mem_d → IR +1 → alu alu →PC	IR
	X
	X-X
	HKT
	SB

IR_(11-9) → rf-a1 IR_(8-6) → rf-a2 rf-d1 → t1 rf-d2 → t2	NONE
	X
	X-X
	GET_AB
	QB

t1 → alu t2 →alu alu → t3	NONE
	ADD
	C-Z
	ALU
	STORE_C

t3 → rf-d3 IR_(5-3) → rf-a3	NONE
	X
	X-X
	STORE_C
	SET_PC

111 → rf_a3 PC → rf_d3	NONE
	X
	X-X
	SET_PC
	IB

2. & 3. ADC/Z

111 → rf-a1 rf-d1 → Mem-a,alu Mem_d → IR +1 → alu alu →PC	IR
	X
	X-X
	HKT
	SB

If (C/Z==0)

111 → rf_a3 PC → rf_d3	NONE
	X
	X-X
	SET_PC
	IB

If (C/Z==1)

IR_(11-9) → rf-a1 IR_(8-6) → rf-a2 rf-d1 → t1 rf-d2 → t2	NONE
	X
	X-X
	GET_AB
	QB

t1 → alu t2 →alu alu → t3	NONE
	ADD
	C-Z
	ALU_ADD
	STORE_C

t3 → rf-d3 IR_(5-3) → rf-a3	NONE
	X
	X-X
	STORE_C
	SET_PC

111 → rf_a3 PC → rf_d3	NONE
	X
	X-X
	SET_PC
	IB

4. ADI

111 → rf-a1 rf-d1 → Mem-a,alu Mem_d → IR +1 → alu alu →PC	IR
	X
	X-X
	HKT
	SB

IR_(11-9) → rf-a1 IR_(8-6) → rf-a2 rf-d1 → t1 rf-d2 → t2	NONE
	X
	X-X
	GET_AB
	QB

IR(5-0) → sgn-10 → alu t2 → alu alu → t3	NONE
	ADD
	C-Z
	ADDI
	PB

t3 → rf -d3 IR_(7-5) → rf-a3	NONE
	X
	X-X
	STORE_C
	SET_PC

111 → rf_a3 PC → rf_d3	NONE
	X
	X-X
	SET_PC
	IB

5. NDU

111 → rf-a1 rf-d1 → Mem-a,alu Mem_d → IR +1 → alu alu →PC	IR
	X
	X-X
	HKT
	SB

IR_(11-9) → rf-a1 IR_(8-6) → rf-a2 rf-d1 → t1 rf-d2 → t2	NONE
	X
	X-X
	GET_AB
	QB

t1 → alu t2 →alu alu → t3	NONE
	NAND
	X-Z
	ALU
	STORE_C

t3 → rf -d3 IR_(5-3) → rf-a3	NONE
	X
	X-X
	STORE_C
	SET_PC

111 → rf_a3 PC → rf_d3	NONE
	X
	X-X
	SET_PC
	IB

6. & 7. NDC/Z

111 → rf-a1 rf-d1 → Mem-a,alu Mem_d → IR +1 → alu alu →PC	IR
	X
	X-X
	HKT
	SB

If (C/Z==0)

111 → rf_a3 PC → rf_d3	NONE
	X
	X-X
	SET_PC
	IB

If (C/Z==1)

IR_(11-9) → rf-a1 IR_(8-6) → rf-a2 rf-d1 → t1 rf-d2 → t2	NONE
	X
	X-X
	GET_AB
	QB

t1 → alu t2 →alu alu → t3	NONE
	NAND
	X-Z
	ALU
	STORE_C

t3 → rf -d3 IR_(5-3) → rf-a3	NONE
	X
	X-X
	STORE_C
	SET_PC

111 → rf_a3 PC → rf_d3	NONE
	X
	X-X
	SET_PC
	IB

8. LHI

111 → rf-a1 rf-d1 → Mem-a,alu Mem_d → IR +1 → alu alu →PC	IR
	X
	X-X
	HKT
	SB

IR(8-0) → trail_zero_7 → rf-d3 IR(9-11) → rf-a3	NONE
	X
	X-X
	LHI
	SET_PC

111 → rf_a3 PC → rf_d3	NONE
	X
	X-X
	SET_PC
	IB

9. LW

111 → rf-a1 rf-d1 → Mem-a,alu Mem_d → IR +1 → alu alu →PC	IR
	X
	X-X
	HKT
	SB

IR_(11-9) → rf-a1 IR_(8-6) → rf-a2 rf-d1 → t1 rf-d2 → t2	NONE
	X
	X-X
	GET_AB
	QB

IR(5-0) → sgn-10 → alu t2 → alu alu → t3	NONE
	ADD
	C-Z
	ADDI
	PB

t3 → mem_a mem_d → t3	NONE
	X
	X-X
	GET_MEM
	ST_MEM

t3 → rf_d3 IR_(8-6) → t3	NONE
	X
	X-X
	ST_MEM
	SET_PC

111 → rf_a3 PC → rf_d3	NONE
	X
	X-X
	SET_PC
	IB

10. SW

111 → rf-a1 rf-d1 → Mem-a,alu Mem_d → IR +1 → alu alu →PC	IR
	X
	X-X
	HKT
	SB

IR_(11-9) → rf-a1 IR_(8-6) → rf-a2 rf-d1 → t1 rf-d2 → t2	NONE
	X
	X-X
	GET_AB
	QB

IR_(5-0) → sgn-10 → alu t2 → alu alu → t3 IR_(9-11) → rf_a1 rf_d1 → t1	NONE
	ADD
	C-Z
	SW1
	SW2

t3 → mem_a t1 → mem_d	DW
	X
	X-X
	SW2
	SET_PC

111 → rf_a3 PC → rf_d3	NONE
	X
	X-X
	SET_PC
	IB

11. LM

111 → rf-a1 rf-d1 → Mem-a,alu Mem_d → IR +1 → alu alu →PC	IR
	ADD
	X-X
	HKT
	SB

IR_(9-11) → rf_a1 rf_d1 → t1 IR_(0-7) → SE(8) → t4	NONE
	X
	X-X
	LM1
	LM2

t1 → mem_a , alu mem_d → t2 +1 → alu alu → t3 t4 → pr.enc → decoder(3 to 8) decoder → t5	DR
	ADD
	X-X
	LM2
	SB

If V = 0

111 → rf_a3 PC → rf_d3	NONE
	X
	X-X
	SET_PC
	IB

If V = 1

t2 → rf_d3 t4 →rf_a3,alu t3 → t1 t5 → alu alu → t4	NONE
	X
	X-X
	LM3
	LM2

12. SM

111 → rf-a1 rf-d1 → Mem-a,alu Mem_d → IR +1 → alu alu →PC	IR
	ADD
	X-X
	HKT
	SB

IR_(9-11) → rf_a1 rf_d1 → t1 IR_(0-7) → SE(8) → t4	NONE
	X
	X-X
	LM1
	LM2

t1 → alu +1 → alu alu → t3 t4 → pr.enc → decoder(3 to 8) decoder → t5	DR
	ADD
	X-X
	LM2
	SB

if V = 0

111 → rf_a3 PC → rf_d3	NONE
	X
	X-X
	SET_PC
	IB

if V =1

t4 → pr.enc → rf_a1 rf_d1 → t4 t3 → t1	NONE
	X
	X-X
	LM3
	LM4

t4 → mem_d3 t1 → mem_a3	DW
	X
	X-X
	LM5
	LM6

t4 → alu t5 → alu alu → t4	NONE
	XOR
	X-Z
	LM6
	LM2

13. BEQ

111 → rf-a1 rf-d1 → Mem-a,alu Mem_d → IR +1 → alu alu →PC	IR
	ADD
	X-X
	HKT
	SB

IR_(11-9) → rf_a1 IR_(8-6) → rf_a2 rf_d1 → t1 rf-d2 →t2	NONE
	X
	X
	GET_AB
	QB

T1 → ALU T2 → ALU ALU → T3	NONE
	SUB
	C-Z
	ALU
	SB

IF (Z = 0)

111 → rf_a3 PC → rf_d3	NONE
	X
	X-X
	SET_PC
	IB

IF (Z = 1)

PC → ALU IR_(5-0) → SE10 → ALU ALU → PC	NONE
	ADD
	X-X
	SE10-PC
	SET_PC

111 → rf_a3 PC → rf_d3	NONE
	X
	X-X
	SET_PC
	IB

14. JAL

111 → rf-a1 rf-d1 → Mem-a,alu Mem_d → IR +1 → alu alu →PC	IR
	X
	X-X
	HKT
	SB

IR_(9_11) → RF_A3 PC → RF_D3, ALU IR_(0_8) → SE7 → ALU ALU → T3	NONE
	ADD
	X-X
	SE7-PC
	T3-PC

111 → RF_A3 T3 → RF_D3	NONE
	X
	X-X
	T3-PC
	IB

15. JLR

111 → rf-a1 rf-d1 → Mem-a,alu Mem_d → IR +1 → alu alu →PC	IR
	X
	X-X
	HKT
	SB

IR_(11-9) → rf_a1 IR_(8-6) → rf_a2 rf_d1 → t1 rf-d2 →t2	NONE
	X
	X
	GET_AB
	QB

PC→ RF_D3 IR_(9_11) → RF_A3	NONE
	X
	X-X
	PC-REG
	T2-PC

T2 → RF_D3 111 → RF_A3	NONE
	X
	X-X
	T2-PC
	IB