

Computation Structures — Tutorial 12

December 20, 2016

1 A β Machine with a 2-Stage Pipeline

1. Give a plausible implementation of `NOP()`.
2. Give a *software* solution to the jump problems for each of the following programs:

(a)	1	Main:	ADDC(R31,0,R1)	(b)	1	Cas1:	ADDC(R1,4,R1)
	2		ADDC(R31,2,R2)		2		SUBC(R2,12,R2)
	3	Incr:	ADDC(R1,5,R1)		3		CMPLT(R1,R2,R0)
	4		SUBC(R2,1,R2)		4		BNE(R0,Cas2)
	5		BT(R2,Incr)		5		MULC(R1,5,R1)
	6	Oper:	ADD(R1,R3,R3)		6		BR(rtn)
					7	Cas2:	MULC(R2,5,R2)
					8		BR(rtn)

2 A β Machine with a 4-Stage Pipeline

1. Give a software *and* a hardware solution to the data conflicts problems for the following program:

```
1 ADD(R1,R2,R3)
2 SUB(R3,R4,R5)
3 MULC(R2,5,R17)
4 ADD(R5,R1,R1)
5 SUB(R17,R1,R17)
```

2. Give a *hardware* solution to the data conflicts problems for the following program:

```
1 LD(R1,0,R4)
2 ADD(R1,R4,R5)
3 XOR(R3,R4,R6)
```

3. If the β Machine features 2 *bypasses*, what will be the result stored at 0x1000 after the execution of the following program? Why?

```
1 ADDC(R31,3,R0)
2 SUBC(R0,1,R1)
3 MUL(R0,R1,R2)
4 XOR(R0,R2,R3)
5 ST(R3,0x1000,R31)
```