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WE15.2

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Video explanation of solution is provided below the problem.

Beta Junkyard

4 points possible (ungraded)
You’ve discovered a secret room in the basement of the Stata center full of discarded 5-stage pipelined Betas. Unfortunately, many have certain defects. You discover that they fall into four categories:

- C1: Completely functional 5-stage Betas with working bypass paths, annulment, and other components.
- C2: Betas with a bad register file: all data read from the register file is zero.
- C3: Betas without bypass paths: all source operands come from the register file.
- C4: Betas without annulment of instructions following branches.

To help sort the Beta chips into the above classes, you write the following small test program:

```
. = 0x0
// Start at 0x0, with ZERO in all registers
ADDC(R31, 4, R0)
BEQ(R31, X, R2)
MULC(R2, 2, R2)
X: SUBC(R2, 4, R2)
  ADD(R0, R2, R3)
  JMP(R3)
```

Your plan is to single-step through the program using each Beta chip, carefully noting the address the final JMP loads into the PC. Your goal is to determine which of the above four classes a chip falls into by this JMP address.

For each class of Beta processor described above, specify the value that will be loaded into the PC by the final JMP instruction.

Pipeline diagram showing first 7 cycles of test program executing on C1:

Cycle	0	1	2	3	4	5	6
IF	ADDC	BEQ	MULC	SUBC	ADD	JMP	
RF		ADDC	BEQ	NOP	SUBC	ADD	JMP
ALU			ADDC	BEQ	NOP	SUBC	ADD
MEM				ADDC	BEQ	NOP	SUBC
WB					ADDC	BEQ	NOP


C1: JMP goes to address:

C2: JMP goes to address:

C3: JMP goes to address:

C4: JMP goes to address:

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(Caption will be displayed when you start playing the video.)

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