3.21, 3.22, Use $0x_D780\ 0000$, 3.23 use 279.4375 — Chris Bero
3.24 use 279.4375, 3.28, 4.3.1, 4.3.2, 4.7.4, 4.7.5

HW — CPE 431

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3.21 $0x_0C00\_0000$

0000 1100 0000 0000

31 26 → 000011 matches the 'jal' instruction

→ Jal 0

3.22. $0x_D780\ 0000$ to decimal.

a. 1101 0111 1000 0000 0000 0000 0000 0000

Sign bit: 1, negative

Exponent: 175 − 127 = 48

Fraction: 0

$-1 \times 1.0 \times 2^{48} = -1 \times 2.814 \times 10^{14} = \boxed{-2.814 \times 10^{14}}$

3.23 279.4375_{10} → IEEE 754 Single

$1000\ 1011_2 \rightarrow 279$ $\quad 0.4375 \rightarrow 7/16 \rightarrow {}^{0111}/_{2^4}$

$1000\ 1011\ 1.0111 \times 2^0 \rightarrow 1.0001\ 0111\ 0111 \times 2^8$

0 | 1000 0111 | 0001 0111 0111 0000 0000 000

$0x_43\,8B\,B8\,00$

3.24 279.4375 → IEEE 754 Double

Double precision: 11 bits exponent (error on pg. 198)

52 bit fraction

11

0 | 1000 0001 111 | 0001 0111 0111 0...

$0x_40717700\ 00000000$

fraction | S | exp

3.28 32 bits: 31 16 15 8 7 0

-5 $-1 \times 0.15625 \rightarrow 0101/32 \rightarrow 0101/2^5 \rightarrow 0101 \times 2^{-5} \rightarrow 0.00101_2$

0101 1011 $0.00101_2 \rightarrow 1.01_2 \times 2^{-3}$

1010 0100 Fraction: 0100 0000 0000 0000 0000 0000

1011 0101 2_s comp: 1011 1111 1111 1111 1111 1111 +1

1100 0000 0000 0000 0000 0000

|1100 0000 0000 0000 0000 0000|1|000 0011|

0xC0000083

4.3.1

	I-Mem	Add	Mux	ALU	Regs	D-Mem	Control
ps	400	100	30	120	200	350	100
Cost	1000	30	10	100	200	2000	500

400 + 30 + 120 + 30 + 200 + 350 + 30 = 1160

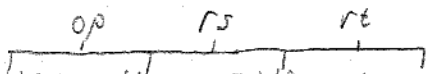
Without: 1160 ps , With: 1460 ps

4.3.2 5% fewer instructions, 8% longer clock cycle.

$\frac{1160}{1460} = 0.79 \cdot 1.05 = 0.83$ speed-up

105%

4.7.4



opcode: $101011_2 \rightarrow 43_{10} \rightarrow$ SW

rs : $00011 \rightarrow 3$

rt : $00010 \rightarrow 2$

ALU Data: ALUsrc: 1 → Read sign ext, add

① Read Data 2, Sign extend → (0, 1) → Sign Extend

② Inst [20-16], Inst [15-11] → (0, 1) → X

③ Read Data, ALU Result → (1, 0) → X

④ Add, ALU Result → (0, 1) → Add

① $0x00000014$ ② 0010_2

③ $0x00000017$ ④ PC+4

4.7.5 ALU: - 00011_2
- $0x00000014$

Add: - PC
- 4

Add: - PC+4
- $0x00000050$