

Chapter 3

Arithmetic for Computers



Signed Multiplication?

- Make both positive
 - remember whether to complement product when done
- Apply definition of 2's complement
 - need to sign-extend partial products and subtract at the end
- Booth's Algorithm
 - elegant way to multiply signed numbers
 - using same hardware as before and save cycles



Motivation for Booth's Algorithm

- Example $2 \times 6 = 0010 \times 0110$:

	0010	
x	0110	
<hr/>		
+	0000	shift (0 in multiplier)
+	0010	add (1 in multiplier)
+	0010	add (1 in multiplier)
+	0000	shift (0 in multiplier)
<hr/>		
	00001100	

- ALU with add or subtract gets same result in more than one way:

$$14 = 2 + 4 + 8$$

$$14 = -2 + 16$$

$$001110 = -000010 + 010000 = 111110 + 010000$$

- For example

	0010	
x	0110	
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	0000	shift (0 in multiplier)
-	0010	sub (first 1 in multpl.)
	0000	shift (mid string of 1s)
+	0010	add (prior step had last 1)
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	00001100	

