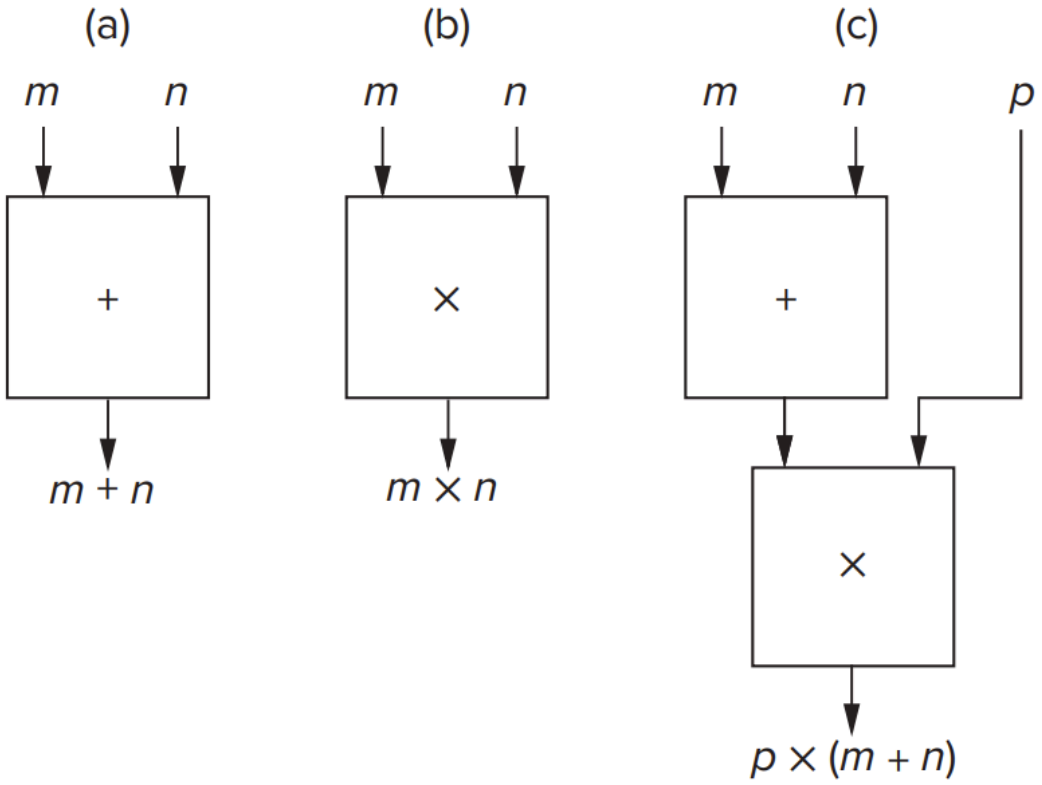
Homework 1

T1

Say we had a “black box,” which takes two numbers as input and outputs their sum. See Figure 1.10a.
Say we had another box capable of multiplying two numbers together. See Figure 1.10b.
We can connect these boxes together to calculate p × (m + n). See Figure 1.10c.



Assume we have an unlimited number of these boxes. Show how to connect them together to calculate:

1. The average of the three input numbers x, y, and z.
2. x+2y+z
3. $xy^2 - x^2y$
4. How many boxes do you need at least to calculate x^{11}?

T2

Convert these decimal numbers to 8-bit 2's complement numbers:

1. 73
2. 46
3. -115

Convert the following 8-bit 2's complement numbers to decimal:

1. 0101 1010
2. 1111 0110
3. 1000 0110

T3

Compute the following and answer it in decimal. Assume each operand is a 2's complement binary number.

1. 11 + 01010101
2. 01001 - 111010
3. 1010 − 01011

T4

Write your result in binary and decimal.

1. What is the largest positive number one can represent in an eight-bit 2’s complement code?
2. What is the greatest magnitude negative number one can represent in an eight-bit 2’s complement code?
3. What is the largest positive number one can represent in n-bit 2’s complement code?
4. What is the negative number with the largest absolute value one can represent in n-bit 2’s complement code?

T5

Describe what conditions indicate overflow has occurred when two 2’s complement numbers are added?
Describe what conditions indicate overflow has occurred when two unsigned numbers are added?

T6

Write the decimal equivalents for the following IEEE floating point numbers:

1. `0 10010010 01110000000000000000000`
2. `1 00001110 10011000000000000000000`

Write IEEE floating point representation of the following decimal numbers:

1. 5.375
2. $-10\frac{9}{32}$

T7

What are the largest and smallest exponents the IEEE standard allows for a 32-bit floating point number? (Answer in decimal)

What about the smallest number regardless of infinity? And the smallest positive number? (Answer in binary)

T8

Compute the following and answer in **hexadecimal**:

1. (0011 AND 0110) AND 1101
2. 0101 0111 OR NOT(1101 0111)
3. (1101 0010 OR 0001 1001) OR NOT(0110 1101 AND 1010 1110)

What strategy would you use to design a program that can quickly compute the result of a long series of n-bit AND operations?

T9

Refer to Example 2.11(Page 43) for the following questions.

1. What mask value and what operation would one use to indicate that machine 2 is busy?
2. What mask value and what operation would one use to indicate that machines 2 and 6 are no longer busy?
3. What mask value and what operation would one use to indicate that all machines are busy?
4. What mask value and what operation would one use to indicate that all machines are idle?
5. Using the operations discussed in this chapter, develop a procedure to isolate the status bit of **machine 5** as the sign bit. For example, if the BUSYNESS pattern is 01**0**11100, then the output of this procedure is 00000000. If the BUSYNESS pattern is 01**1**10011, then the output is 10000000. ***Hint:*** What happens when you ADD a bit pattern to itself?

T10

Fill in the truth table for the equations given.

`Q1 = NOT(X AND Z) AND (X AND Y OR Z)`

`Q2 = NOT(Y OR Z) AND NOT(X AND Y AND Z)`

X	Y	Z	Q1	Q2