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CS24 Elementary Computer Organization
Assignment 0
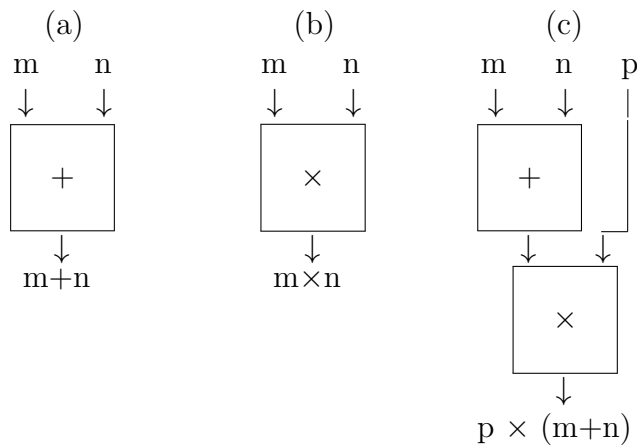
Question 1.
Say we had a "black box," which takes two numbers as input and outputs
their sum. See Figure 1.7a. Say we had another box capable of
multiplying two numbers together. See Figure 1.7b. We can connect these
boxes together to calculate $p \times (m + n)$. See Figure 1.7c. Assume we
have an unlimited number of these boxes. Show how to connect them
together to calculate:

a. $ax + b$
b. The average of the four input numbers w, x, y, and z
c. $a^2 + 2ab + b^2$ (Can you do it with one add box and one multiply box?)

Question 2.
The discussion of abstraction in Section 1.3.1 noted that one does not
need to understand the makeup of the components as long as "everything
about the detail is just fine." The case was made that when everything is
not fine, one must be able to deconstruct the components, or be at the
mercy of the abstractions. In the taxi example, suppose you did not
understand the component, that is, you had no clue how to get to the
airport. Using the notion of abstraction, you simply tell the driver,

(a)   (b)   (c)

m   n   m   n   m   n   p
↓   ↓   ↓   ↓   ↓   ↓
+   ×   +

↓   ↓   ↓   ↓
m+n   m×n   ×

↓
p × (m+n)

Question 3.

Are items a through e in the following list algorithms? If not, what qualities required of algorithms do they lack?

$a.$ Add the first row of the following matrix to another row whose first column contains a nonzero entry. (*Reminder:* Columns run vertically; rows run horizontally.)

$$\begin{bmatrix} 1 & 2 & 0 & 4 \\ 0 & 3 & 2 & 4 \\ 2 & 3 & 10 & 22 \\ 12 & 4 & 3 & 4 \end{bmatrix}$$

Question 4.

Fill in the following truth table for a one-bit AND operation

X	Y	X AND Y
0	0	
0	1	
1	0	
1	1	