

Math Diversion 1084

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Optimism is the faith that leads to achievement. Nothing
can be done without hope and confidence.

— Helen Keller

Source: <http://www.beatthegmat.com/650-800-question-t68610.html>
Title: A percentage problem
Presenter: Patrick

1 Introduction

Sometimes it's better to use a box diagram. The first problem is a case in point, where we use a foursquare.

2 Problem

At a technology consulting firm with x computers, all of which are laptops or desktops, 30% are laptops; if 80% of the total number of computers have more than 1GB of RAM and 10% of the computers with less than 1 GB of RAM are laptops (and no computers have exactly 1GB of RAM), approximately what percent of desktops have more than 1GB of RAM?

- A) 75%
- B) 60%
- C) 52%
- D) 40%
- E) 45%

3 Solution

Who! This problem has enough information for two diagrams, where you add parts to get their totals. Exactly. To accommodate this information, we'll employ two figures collapsed into one in the form of a foursquare. See Figure 1.

		Computer Type		
		L T	D T	
RAM	> 1 GB	①	②	.80 X
	< 1 GB	③	④	⑥
		.30 X	⑤	X

Figure 1. We start the process of constructing the foursquare by first noting that the bottom row and the rightmost column must each separately add to X.

Circle 5 and Circle 6 can be determined, respectively, by making the bottom row and right column add to X.

		Computer Type		
		L T	D T	
RAM	> 1 GB	①	②	.80 X
	< 1 GB	③	④	.20 X
		.30 X	.70 X	X

Figure 2. We are told that 10% of the computers with less than 1 GB of RAM are laptops. With this information we can calculate what should go into Circle 3.

The value of Circle 3 is the probability of being less than 1 GB and being a laptop. We can use conditional probabilities to calculate this value.

$$\begin{aligned}
 \Pr((L\ T) \cap (< 1\ \text{GB}\ \text{RAM})) &= \Pr((L\ T) | (< 1\ \text{GB}\ \text{RAM})) \Pr(< 1\ \text{GB}\ \text{RAM}) \\
 &= (.10)(.20) = .02.
 \end{aligned}
 \tag{1}$$

		Computer Type		
		L T	D T	
RAM	> 1 GB	①	②	.80 X
	< 1 GB	.02 X	④	.20 X
		.30 X	.70 X	X

Figure 3. Really — a separate figure just for one square? Yes. Figuring out what should go into Circle 3 is the crux of finishing off the foursquare.

We can now fill in the rest of the foursquare on the principle the values in the rows of the foursquare must add to the subtotals on the right, and that the values in the columns of the foursquare must add to the subtotals in the bottom of the foursquare. We can start with finding either the values that belong in Circle 1 or Circle 4.

		Computer Type		
		L T	D T	
RAM	> 1 GB	.28 X	.52 X	.80 X
	< 1 GB	.02 X	.18 X	.20 X
		.30 X	.70 X	X

Figure 4. With all the values inside the foursquare computed, we can now answer the question asked of us.

So, we were asked this question: Approximately what percent of desktops have more than 1GB of RAM? To which we can report:

$$\Pr((D\ T) \cap (> 1\ \text{GB}\ \text{RAM})) = .52, \tag{2}$$

which, on converting to a percentage, becomes 52%.