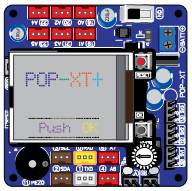

Problem of the Week
Problem A and Solution
Repairing Computers

Problem

In Eris' repair shop, she is usually able to fix seven computers in a regular 8-hour day. Her shop is open Monday through Friday, 9:00 a.m. until 5:00 p.m., and Saturday 9:00 a.m. until 1:00 p.m..

Estimate how many computers is Eris able to fix each week. Justify your thinking.

Solution

During the weekdays, Eris is working 8 hours. On Monday through Friday, she would be expected to fix: $7+7+7+7+7 = 7 \times 5 = 35$ computers. On Saturday she works from 9:00 a.m. until 1:00 p.m., which is a total of 4 hours. Since $4 \div 8 = \frac{1}{2}$, we expect Eris to be able to fix approximately half as many computers on Saturday as she does on a weekday. Unfortunately, half of 7 is not a whole number, and she can only fix whole computers. The closest whole numbers to "half of 7" are 3 and 4. So we expect Eris to fix either 3 or 4 computers that day. We add this to the number she is expected to fix during the week. This means we estimate she fixes $35 + 3 = 38$ computers or $35 + 4 = 39$ computers each week.

There are many factors which may be considered that might make us think it is more likely that she is more likely to fix 3 computers rather than 4 computers or vice versa on a Saturday. For example, we have calculated that Eris is expected to fix $3\frac{1}{2}$ computers in a 4-hour day. However, fixing a $\frac{1}{2}$ a computer means the computer is still broken. This means we should think of this computer as not fixed, so it should not be counted.

Another factor to consider is that we assume that Eris takes a lunch break during an 8-hour day. If she does not take that break on Saturday, that means she has more time to fix computers. If she does take that break on a Saturday, then that is a larger portion of the time her shop is open that is not being used for fixing computers.

Teacher's Notes

The problem statement, "... she is usually able to fix seven computers in a regular 8-hour day" is essentially describing an *expected value*. In statistics, an expected value is the average that has been determined based on data gathered over a long period of time. On any given day, Eris may fix more or less than 7 computers. Notice that the expected value for the number of computers that she can fix on a Saturday is 3.5 machines. Since computers being fixed is a binary state, (they are either broken or they are fixed), Eris cannot actually fix half a computer. So an expected value is not necessary an actual value that can be achieved in the real life situation.

We often use expected values to make decisions. However, when the decision is related to a short-term outcome we may not get the result we want. For example, suppose there is a good strategy for playing a game where you are expected to win 75% of the time if you use it. This means if you play the game 1000 times, you will probably win approximately 750 times. However, when you are playing a single one of those games, there is no guarantee that choosing the good strategy will lead you to a win. When people evaluate results like this in the short term, they may incorrectly conclude that the strategy is ineffective or incorrect. However, mathematicians know that the real payoff is in the long term application of that strategy.