Conditional Probability and Crime

Source: *Dilbert*, Sept. 29, 1992, http://dilbert.com/strips/comic/1992-09-29/. Reprinted with permission.

Although the 2012 U.S. Census does not include data relating to unmarried male criminals specifically, it does have separate data for male criminals and unmarried criminals. According to the 2012 census, there were 613 married and 2,560 unmarried (never married, divorced, or widowed) death row inmates in the year 2009. Further 2012 census data shows that in the year 2009 there were 233,090,322 adults and that 56.4% of the general adult population was married.

1. (*a*) Complete **table 1 ("Conditional Probability and Crime")**, using the 2012 census information that 56.4% of the general population was married and the total number of adults was 233,090,322.

   (*b*) A *conditional probability* written as $P(A|B)$ measures the probability of an event, A, given that another event, B, is occurring or has already occurred. We can compute this probability as follows:

$$P(A \mid B) = \frac{n(A \text{ and } B)}{n(B)}$$

   Let U denote the event that someone is unmarried. Let D denote the event that someone is on death row. Use the data in the table to calculate $P(U|D)$ and $P(D|U)$. Explain why the two probabilities, $P(U|D)$ and $P(D|U)$, are so different.

Table 1 ("Conditional Probability and Crime")

	On Death Row	Not on Death Row	Total
Married	613		
Unmarried	2,560		
Total			233,090,322

2. (*a*) From the 2012 census, we know that 50.8% of the U.S. population is female. In addition, 667,039 men and 93,176 females are in jail. Complete **table 2 ("Conditional Probability and Crime")**.

   (*b*) Let M denote the event that someone is male. Let J denote the event that someone is in jail. Without actually calculating the conditional probabilities, predict whether the two calculations, $P(M|J)$ and $P(J|M)$, are likely to be similar or different in this context. Explain your thinking.

   (*c*) For A and B as in part (*b*), use the data in **table 2 ("Conditional Probability and Crime")** to calculate $P(M|J)$ and $P(J|M)$.

   (*d*) Are the final answers in question 2(*b*) equal? Why or why not?

   (*e*) Does it appear that men commit 90% of violent crime? Does your answer support or contradict the claim in the cartoon?

Table 2 ("Conditional Probability and Crime")

	In Jail	Not in Jail	Total
Male	667,039		
Female	93,176		
Total			233,090,322

Table 3 ("Conditional Probability and Crime")

	B	Not *B*	Total
A			
Not *A*			
Total			

3. (*a*) Create your own situation in the two-way table (**table 3 ["Conditional Probability and Crime"]**) so that $P(A|B) = P(B|A)$.

   (*b*) In general, if $P(A|B) = P(B|A)$ for two events A and B, what must be true about events A and B?