3. In 2008 a college was shut down because of high rates of norovirus in the student population. The following table gives the numbers of male and female students who did and did not contract the virus at that time. We will let F and M represent the event that a randomly chosen student is female and male, respectively, and Y and N represent the event that a randomly chosen student contracted the norovirus or not, respectively.

		Female	Male	Total
Contracted norovirus	Yes	212	124	336
	No	1,049	479	1,528
Total		1,261	603	1,864

(a) What is the value of $P(Y)$ and what does it mean in the context of this situation?

The probability that a randomly chosen student got the norovirus is 336/1,864 = 0.180.

(b) What is the value of $P(Y|F)$ and what does it mean in the context of this situation?

The probability that a randomly chosen female got the norovirus is 212/1,261 = 0.168.

(c) Did males and females contract the norovirus at the same rates?

No, the male rate was 124/603 = 0.206 whereas the female rate was 0.168.

(d) If males and females contracted the norovirus at the same rates, would that mean the events Y and F have to be independent? Explain.

Yes. If the male rate was the same as the female rate then both of these would have to be the same as the overall rate.

5. The percentage of HIV positive individuals among blood donors in the United States is 0.003%. One of the tests available for detecting the HIV virus is the HIV antibody test (Ab). The Ab test is positive in 94% of the individuals who are HIV positive, and it is negative in 98% of the individuals who are HIV negative.
   The Ab test is administered to a randomly selected individual in a sub-population with a HIV positive percentage of 0.003%

   (a) What are the given probabilities and their compliments?

   P(HIV+) = .00003 P(HIV-) = .99997
   P(Ab+|HIV+) = 0.94 P(Ab-|HIV+) = .04
   P(Ab-|HIV-) = 0.98 P(Ab+|HIV-) = .02

   (b) What is the probability that the test result is positive?

   P(Ab+) = P(Ab+|HIV+)P(HIV+) + P(Ab+|HIV-)P(HIV-) = .94(.00003) + .02(.99997) = 0.02

   (c) Given that the test is positive, what is the probability that the individual is HIV positive (has the HIV virus)?

   P(HIV+|Ab+) = P(HIV and Ab+)/P(Ab+) = P(Ab+|HIV+)P(HIV)/P(Ab+) = 0.00141