Problem Set #6

Tuesday, September 20, 2022 8:51 AM

1. 3.9% vaccinated, 13.7% of those exposed died, 2.46% of vaccinated died, 100% was exposed at some point. Let V be vaccinated and D be died
   a. $P(V|D) = \frac{P(D|V) * P(V)}{P(D)} = \frac{2.46\% * 3.9\%}{13.7\%} = 0.7003\%$
2. 3% use heroin, drug test correctly identifies heroin users 95% of the time and correctly identifies non-users 90% of the time. Let H be uses heroin, let T be positive test
   a. True/false positives and true/false negatives
      i. True positive: $P(T|H) = 95\%$
      ii. False positive: $P(T|!H) = 100\% - 90\% = 10\%$
      iii. True negative: $P(!T|!H) = 90\%$
      iv. False negative: $P(!T|H) = 100\% - 95\% = 5\%$
   b. $P(T) = P(T|H) * P(H) + P(T|!H) * P(!H) = 95\% * 3\% + 10\% * 97\% = 12.55\%$
   c. $P(H|T) = \frac{P(T|H) * P(H)}{P(T)} = \frac{95\% * 3\%}{12.55\%} = 22.7092\%$
3. 20% are spam, spam contains "free" 40% of the time and not spam contains "free" 5% of the time. Let S be spam, let F be includes "free"
   a. $P(S) = 20\%, P(F|S) = 40\%, P(F|!S) = 5\%$
   b. $P(F) = P(F|S) * P(S) + P(F|!S) * P(!S) = 40\% * 20\% + 5\% * 80\% = 12\%$
   c. $P(S|F) = \frac{P(F|S) * P(S)}{P(F)} = \frac{40\% * 20\%}{12\%} = \frac{2}{3}$
4. For question 1:
   a.

	V	!V	
D	2.46%*3.9%=0.0959%	13.7%-0.0959%=13.6041%	13.7%
!D	3.9%-0.0959%=3.8041%	96.1%-13.6041%=82.4959%	86.3%
	3.9%	96.1%	100%

   b. $P(V|D) = \frac{0.0959\%}{13.7\%} = 0.7\%$
   c. It does work it's just a lot more work and very inefficient.