Bayes Rule and Testing

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Preliminaries and Objectives

Preliminaries

- Probability of Events

Objectives

- Find the probability that a test subject is positive given that they tested positive.

Dragon Pox epidemic

In a community of 10,000 people, 2% of the population is infected with dragon pox. There is a test to determine whether or not an individual has dragon pox that is quite accurate. If you have dragon pox, the test will correctly determine that 99% of the time. It will read a 'false negative' only 1% of the time. Similarly, if you do not have the disease, the test will correctly determine that 97% of the time and will give a 'false positive' reading to 3% of disease-free individuals. If you test positive for dragon pox, how likely are you to actually have the disease?

Bayes Rule

pop. = 10000	Tested positive	Tested negative	
infected	99% 198	1% 2	2% 200
not infected	3% 294	97% 9506	98% 9800
Total	492	9508	10000

$$P(\text{infected} \mid +) = \frac{198}{492} \approx 40.2\%$$

Bayes Rule

	Tested positive	Tested negative	
infected	$(.99)(.02) = .0198$	$(.01)(.02) = .0002$	0.02
not infected	$(.03)(.98) = .0294$	$(.97)(.98) = .9506$	0.98
Total	.0492	.9508	

$$P(\text{infected} \mid +) = \frac{0.0198}{0.0492} \approx 40.2\%$$