3/~~19~~ 21/2019

25.1

~~24.7~~

(a): We are told that the test returns negative for 10% of sick students and 70% of healthy students; there are 100 students, 20 of which are sick and the remaining 80 are not. Then, 2 of the sick students return negative and 56 of the healthy students return negative. The probability of being a sick student given that the test result is negative is then:

$$\frac{2}{2+56} \cdot 100\% = 3.45\%$$

(b): We are going to multiply the initial ratio of good:Bad by the chances of those emitting sparks;

$$90\% : 10\% \cdot 4\% : 12\% = 3.6\% : 1.2\%$$

$$= 36 : 12$$

Now that we have calculated the ratio of good:Bad widgets that spark, find the probability of getting a bad widget:

$$\frac{12}{36+12} = \frac{12}{48} = 25\%$$

(c): The probability form returns the percent chance of the outcome in question occuring, while the odds form returns a ~~ration~~ ratio of the composition of the overlapping outcomes. We add the value of the numerator to the denominator, ~~for ex~~ to find the probability; given the ratio, ~~the pr~~

$$\left(\frac{Z}{K}\right)$$

the probability can be written as

$$\frac{Z}{K+Z}$$

Now we'd like to prove Baye's rule, that

$$\frac{P(H_j)}{P(H_k)} \cdot \frac{P(e_0 | H_j)}{P(e_0 | H_k)} = \frac{P(H_j | e_0)}{P(H_k | e_0)}$$

We see by the definition of conditional probability that $P(X \wedge Y) = P(Y) \cdot P(X | Y)$, thus

$$\ldots = \frac{P(e_0 \wedge H_j)}{P(e_0 \wedge H_k)}$$ where $\wedge$ is the intersection of the prob.

multiply this by $\frac{1}{e_0} / \frac{1}{e_0}$ and note that intersection is commutative

$$\ldots = \cancel{\frac{P(e_0 / H_j)/e_0}{}} = \frac{P(H_j \wedge e_0)}{P(H_k \wedge e_0)} \cdot \frac{1/e_0}{1/e_0} = \frac{P(H_j \wedge e_0)/e_0}{P(H_k \wedge e_0)/e_0}$$

Recall that $P(X \wedge Y) / P(Y) = P(X | Y)$

$$\ldots = \frac{P(H_j | e_0)}{P(H_k | e_0)}$$