

CS 440/ECE448 Homework 4

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Problem 1

1. $P(\neg a) =$

$$0.05 + 0.10 + 0.15 + 0.15$$
$$0.45$$

2. $P(B) =$

$$P(b) = 0.20 + 0.10 + 0.05 + 0.10.$$
$$P(b) = 0.45.$$
$$P(\neg b) = 0.10 + 0.15 + 0.15 + 0.15$$
$$P(\neg b) = .55.$$
$$P(b) + P(\neg b) = 1$$

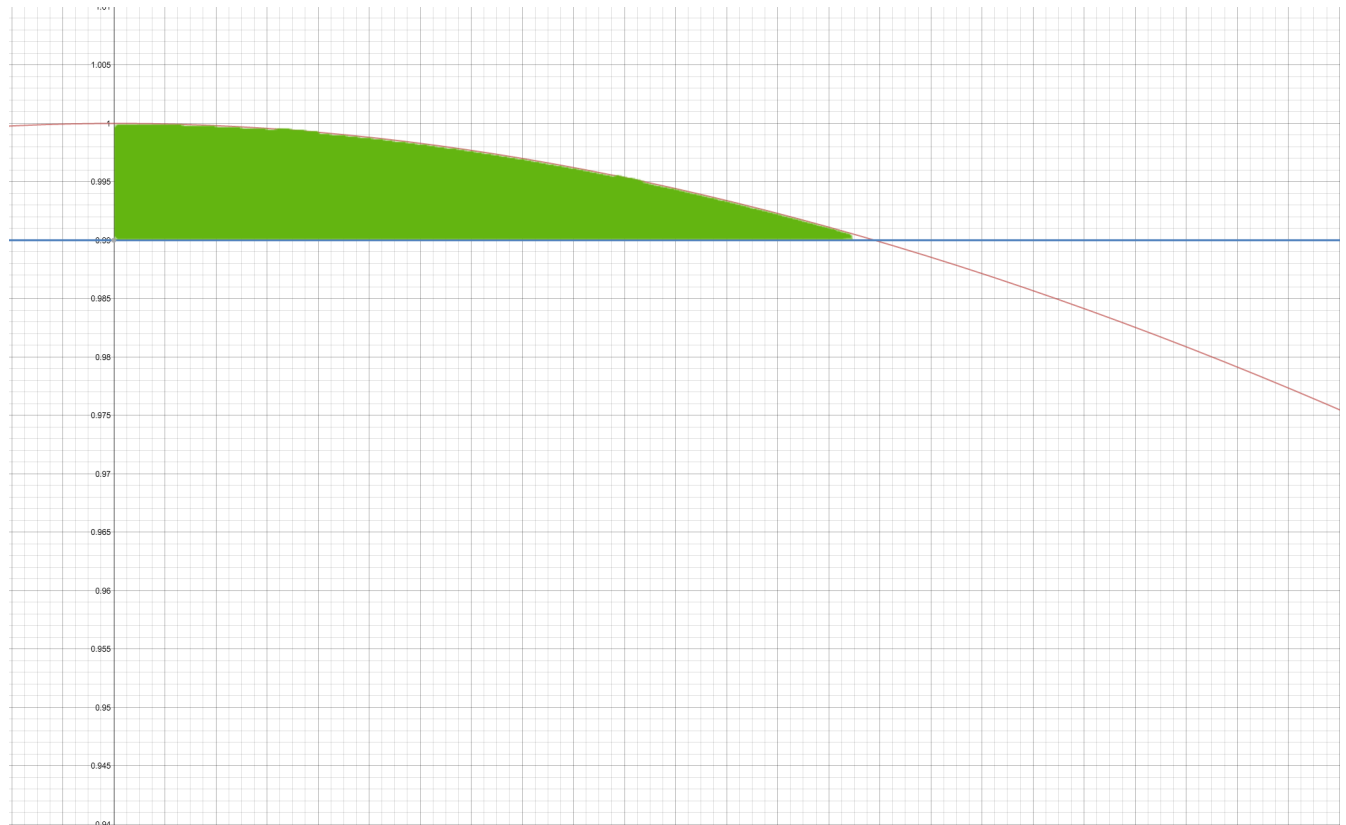
3. $P(A|b) =$
 $P(A)$ is

$$P(a) = 0.20 + 0.15 + 0.10 + 0.15$$
$$P(a) = 0.55$$
$$P(\neg a) = 0.15 + 0.15 + 0.10 + 0.05$$
$$P(\neg a) = 0.45$$
$$P(\neg a) + P(a) = 1$$

And we can calculate the probability of $P(x|y)$ as $\frac{P(xy)}{P(y)}$. Thus we can say:

$$\frac{P(ab)}{P(b)} = \frac{0.3}{0.45} = \frac{2}{3}$$
$$\frac{P(\neg ab)}{b} = \frac{0.15}{0.45} = \frac{1}{3}$$

Problem 2



- 1.
2. To find the value of n , simply find the intersect of the two lines graphed above. This value is: 148 bags.

Problem 3

It is known that Bayes' Theorem states:

$$P(A|B) = \frac{P(B|A)P(A)}{P(B)}$$

This can equally be represented as:

$$P(A|B) = \frac{P(B|A)P(A)}{P(B|A)P(A) + P(B|\neg A)P(\neg A)}$$

We have also been given information stating that:

$$P(\text{Predicted}|\text{Rain}) = 0.99$$

and

$$P(\text{Predicted}|\neg \text{Rain}) = 0.01$$

Thus we can say:

$$P(Rain|Prediction) = \frac{P(Prediction|Rain)P(Rain)}{P(Prediction|Rain)P(Rain) + P(Prediction|\neg Rain)P(\neg Rain)}$$

Thus:

$$P(Rain|Prediction) = \frac{0.99 * \frac{1}{10000}}{0.99 * \frac{1}{10000} + 0.01 + \frac{9999}{10000}}$$

$$P(Rain|Prediction) = 0.9804\%$$

Problem 4

Supposing that $P(A, B|C) = P(A|C)P(B|C)$, it can be said:

$$P(A, B|C) = P(A|C)P(B|C)$$

$$\frac{P(A, B, C)}{P(C)} = P(A|C)P(B|C)$$

$$\frac{P(A|B, C)P(B, C)}{P(C)} = P(A|C)P(B|C)$$

$$\frac{P(A|B, C)P(B, C)P(C)}{P(C)} = P(A|C)P(B|C)$$

$$P(A|B, C)P(B, C) = P(A|C)P(B|C)$$

Hence:

$$P(A|B, C) = P(A|C)$$