

Bayes Theorem problems

Math 10120, spring 2013

February 27, 2013

1. **Should you worry when you test positive?**

2% of the population have condition X.

There's a test for X.

Used on subjects who have X, it correctly detects X 98% of the time.

Used on subjects who do not have X, it correctly detects the absence of X 97% of the time.

I take the test, and it comes up positive. Do I have X?

2. **Who's Joe gonna call?**

The census tells us the following about the adult population of South Bend:

- 10% are African-American (A)
- 15% are Hispanic (H)
- 70% are White (W)
- 5% are none of the above (O)

Democrat party polling tells us that the democrats have the following support among various groups:

- 70% among African-American
- 55% among Hispanic
- 60% among White
- 50% among other groups

Senator Joe Donnelly (D-IN) gets a call from a South Bend voter. His assistant tells him "it's a supporter". What's the probability that Joe is being called by an African-American?

3. **Who wrote the play?**

A manuscript of a 16th century play is found. Based on where it was found, and other historical information, scholars assess that the play was written by

- Shakespeare — with probability 60%
- Bacon — with probability 40%

A probabilist picks a 1000-word chunk of the play, and counts 8 occurrences of the word "thus". She extensively examines the known works of Shakespeare and Bacon, and concludes that in a randomly picked 1000-word chunk of their known writings, the probabilities that each of them use "thus" 8 times are

- 8% for Shakespeare
- 2% for Bacon (he's more a "so" man)

Accepting the scholars data as valid, what is the new probability that Shakespeare wrote the play, based on this new evidence?