1. A spam filter is designed by looking at commonly occurring phrases in spam. Suppose that 80% of email is spam. In 10% of the spam emails, the phrase “free money” is used, whereas this phrase is only used in 1% of non-spam emails. A new email has just arrived, which does mention “free money”. What is the probability that it is spam?

**Ans:** Let S be the event that an email is spam and F be the event that an email has

the “free money” phrase. By Bayes’ Rule,

P (S|F ) = P (F |S)P (S)/P (F )

= (0.1 \* 0.8)/(0.1 \* 0.8 + 0 .01 \*0.2)

= (80/1000)/(82/1000)

=80/82 =0.97