## Some Applications

## Secure communication. Secure signature.

You are in a remote country with email but not telephone contact. You want your parents to deposit $\$ 5,000$ in a local bank account there. How do you prove to them that the message is really from you and that it has not been tampered with?

## Bayesian Probability

1. Say a 20 year old friend is tested for a relatively rare cancer that occurs in only 1 out of every 1,000 people her age. The test is 99accurate in the sense that only $1 \%$ of those who do not have the cancer still test positive and $95 \%$ of those who have the cancer test positive.
a) If your friend tests positive, what is the likelihood that she has the cancer?
b) If your friend tests negative, what is the likelihood that she has the cancer?
c) Repeat parts a) and b) if only 1 out of every 10,000 people her age have the cancer.
2. Your next-door neighbor has a rather old and temperamental burglar alarm. If someone breaks into his house, the probability of the alarm sounding is .95. In the last two years, though, the alarm has gone off on five different nights, each time for no apparent reason. Police records show that the chance of a home in your neighborhood being burglarized on any given night are 2 in 10,000 . If your neighbor's alarm goes off tonight, what is the likelihood his house is being burglarized?
3. During a power blackout, 100 people are arrested on suspicion of looting. Each is given a polygraph test. From past experience it
is known that the polygraph is $90 \%$ reliable when administered to a guilty suspect and $98 \%$ reliable when given to someone who is innocent. Suppose that of the 100 suspects, only 12 were actually involved in any wrongdoing. What is the probability that a given suspect is innocent given that the polygraph says she is guilty?
