

Homework 2, Part 1

September 28, 2011

1. Suppose that the events A , B and C are all mutually independent, and suppose that $\mathbb{P}(A) = 0.1$, $\mathbb{P}(B) = 0.2$ and $\mathbb{P}(C) = 0.3$. Determine $\mathbb{P}(\overline{A} \cup (B \cup C))$, and explain the logic behind your answer.
2. Suppose 1000 people play a pick-3 lottery, where each lottery number is a sequence of 3 digits from 0 through 9, and where the same digit can occur multiple times (so, 000, 010, 001, 123 would all be possible lottery numbers). Suppose also that these 1000 people don't collude, and each picks their number independent of the other players. What is the probability that at least *someone* wins the lottery?
3. An army interrogator, knowing that lie detector tests are only 80% reliable (meaning that if a liar is given the test, the test responds "liar" 80% of the time; and if a truth teller is given the test, the test responds "truth teller" 80% of the time), believes that testing several suspects at once is the key to upping the accuracy of the test.

Suppose you know that 3% of the *suspected* terrorists really are terrorists, and that whenever a suspected terrorist is given the test, they always say "No, I am not a terrorist."

Calculate the probability that if 10 individuals are drawn at random from the whole population of suspected terrorists, and are tested, then at least one of them is a terrorist, given that the tests say 8 of them are liars and 2 of them are truth tellers.