Exercise sheet 3

Probability and Statistics, MTH102

1. If a pair of dice is rolled and we know that the numbers on it are different, what is the probability that one of them is a 4?

2. Suppose 90% of all the students who attend the lectures regularly pass a certain course. While, only 30% of students who do not attend the lectures regularly pass the course. If I know that a student passed the course, what is the probability that that student attended regularly? Assume that half the students attended the course regularly.

3. Prove that if E and F are independent events, then so is E and F^c.

4. If three cards are in a box so that one card has both sides black, another has has both sides white, and the remaining card has one side black and one side white. If a card is picked at random and is found to have one side white, what is the probability that the other side is black?

5. A scientist has four competing hypothesis, say H_1, H_2, H_3, and H_4 for a particular phenomenon. Initially, the scientist assumes that H_1 is very likely and believes the probability to be around 0.7. However, the scientist believes that the other 3 hypotheses are equally likely. To test this the scientist performs an experiment and obtains some outcome E. Unfortunately, the experiment is not foolproof. If H_1 were true, then the probability of the experimental outcome being E is 0.1. However, if H_2 were true, then E may still occur with probability 0.8, if H_3 were true, then the probability of the experimental outcome being E is 0.2, and if H_4 were true, then the probability of the experimental outcome being E is 0.1. How should the scientiest update the probabilities of H_1, H_2, H_3, and H_4, now that the experiment has been performed and resulted in outcome E.