Department of Computer Science and Engineering
M.Tech. I Computer Science and Engineering
Mathematical Foundations of Computer Science CSE 601
Tutorial 3

1. Define an experiment of rolling two fair dice and recording the total number of pips on the top faces. Find the probability that the total number of pips is nine given that the first die shows five pips on its top face.
2. Suppose it is estimated that 10% of a population has a certain disease. Tests for this disease are being developed but are not yet perfect. In fact, an individual who has the disease may test negative. Suppose experience with a particular test shows that 5% of the results are actually false negatives- that is, the individual actually does have the disease. Also, suppose that 8% of the tests done so far have been positive. What is the probability that a sick person will receive a false-negative test result?
3. Suppose we have two coins. One is fair, but the other one has two heads. We choose one of them at random and flip it. It comes up heads.
    a. What is the probability the coin is fair?
    b. Suppose we flip the same coin a second time. What is the probability that it comes up heads?
    c. Suppose the coin comes up heads when flipped the second time. What is the probability the coin is fair?
4. A television show features the following weekly game: A sports car is hidden behind one door, and a goat is hidden behind each of two other doors. The moderator of the show invites the contestant to pick a door at random. Then, by tradition, the moderator is obligated to open one of the two doors not chosen to reveal a goat (there are two goats, so there is always such a door to open). At this point, the contestant is given the opportunity to stand pat (do nothing) or to choose the remaining door. Suppose you are the contestant, and suppose you prefer the sports car over a goat as your prize. What do you do? (Hint: It may help to model this as a two-stage dependent trials process, but it may not be obvious how to do this).
5. Two manufacturing companies M1 and M2 produce a certain unit that is used in an assembly plant. Company M1 is larger than M2, and it supplies the plant with twice as many units per day as M2 does. MI also produces more defects than M2. Because of past experience with these suppliers, it is felt that 10% of MI's units have some defect, whereas only 5% of M2 's units are defective. Now, suppose that a unit is selected at random from a bin in the assembly plant.
    a. What is the probability that the unit was supplied by company M1?
    b. What is the probability that the unit is defective?
    c. What is the probability that the unit was supplied by M1 if the unit is defective?
6. A computer salesperson makes either one or two sales contacts each day between 1 and 2 PM. If only one contact is made, the probability is 0.2 that a sale will result and 0.8 that no sale will result. If two contacts are made, the two customers make their decisions independently of each other, each purchasing with probability 0.2 and not purchasing with probability 0.8. What is the probability that the salesperson has made two sales this hour?
7. Only 1 in 1000 adults is afflicted with a particular rare disease for which a diagnostic test has been developed. The test is such that when an individual actually has the disease, a positive result will occur 99% of the time, and an individual without the disease will show a positive test result only 2% of the time. If a randomly selected individual is tested and the result is positive, what is the probability that the individual has the disease? Draw a tree diagram for the problem.
8. University has 15,000 students. Let X be the number of courses for which a randomly chosen student is registered. No student is registered for more than seven courses, and each student is registered for at least one course. The number of students registered for i courses where $1 \leq i \leq 7$ is 150, 450, 1950, 3750, 5850, 2550, and 300, respectively. Compute the expected value of the random variable X.