ECSE231L – Probability and Statistics
Practice Questions - 1

1. A and B are two events such that $P(A^c) = 0.6$ and $P(A \cap B) = 0.3$ Then, what will be the value of $P(A \cap B^c)$?

2. Let A and B be two events such that P(A) = 0.2 While P(A or B) = 0.5. Let P(B) = P. For what values of P, A and B are independent?

3. If A and B are two mutually exclusive events with $P(A^c) = 5/6$ and P(B) = 1/3, then $P(A \mid B^c) = ?$

4. A person was afraid that he has a rare disease. He therefore went to the doctor and got himself tested. The test came back positive. The accuracy of the test is 98%. However, being a rare disease, only one out of 10,000 people is affected by the disease. Calculate the probability that the person really has the disease given that he was tested positive. Assume false positive rate to be 2%.

5. A bag contains 5 red and 3 yellow balls. Two balls are picked at random. What is the probability that both are of the same colour?

6. Three companies C1, C2 and C3 supply 20%, 30% and 50% of the pens to a school. Past experience shows that 6%, 7% and 3% of the pens produced by these companies are defective. If a randomly picked pen is found to be defective, what is the probability that the pen was supplied by C2?

7. Suppose you draw 3 balls one by one from a jar containing 7 red and 3 blue balls. You set the drawn ball aside if it is red, and put the ball back into the jar if it is blue. What is the probability that the third ball will be blue?

8. Suppose that P(A) = 0.4, P(B) = 0.3 and $P((A \cup B)^c) = 0.42$. Are A and B independent?

9. Your new neighbours have 2 children and you know at least one of them is a boy. You see one of them playing in the backyard and he is a boy - what is the probability the other child is a boy too? (Assume boys and girls are born with equal probability).

10. An urn contains 4 tickets numbered 1, 2, 3, 4; and another urn contains 6 tickets numbered 2, 4, 6, 7, 8, 9. If one of the two urns is chosen at random and a ticket is drawn at random from the chosen urn, find the probabilities that the ticket drawn bears the number:
    (a) 2 or 4 (b) 3 (c) 1 or 9

11. In a region, 60% of the registered voters are Republicans; 30% are Democrats; and 10% are Independents. When these voters were asked about increasing military spending; 40% of Republicans opposed it, 65% of the Democrats opposed it; and 55% of the Independents opposed it. What is the probability that a randomly selected voter in this region opposes increased military spending?

12. An aircraft maintenance company bought equipment for detecting structural defects in aircraft. Tests indicate that 95% of the time the equipment detects defects when they actually exist, and 1% of the time it gives a false alarm that indicates the presence of a structural defect when in fact there is none. If 2% of the aircrafts actually have structural defects, what is the probability that an aircraft has a structural defect given that the equipment indicates that it has a structural defect.

13. Suppose it is known that 1% of the population suffers from a particular disease. A blood test has a 97% chance of identifying the disease for diseased individuals, but also has a 6% chance of falsely indicating that a healthy person has the disease.
    a. What is the probability that a person will have positive blood test?
    b. If your blood test is positive, what is the chance that you have the disease?
    c. If your blood test is negative, what is the chance that you do not have the disease?

Answers:

1. 0.1
2. 3/8
3. 1/4
4. 0.00487
5. 0.464
6. 0.4375
7. 0.349
8. 0.42
9. 1/3
10. (a) 5/12, (b) 1/8, (c) 5/24
11. 0.49
12. 0.66
13. (a) 0.0691, (b) 0.140, (c) 0.99