

Seminar 15

1. Given that $P(A) = 3/14$, $P(B) = 1/6$, $P(C) = 1/3$, $P(A \text{ and } C) = 1/7$, and $P(B|C) = 5/21$, find the following probabilities:
 - a. $P(A|C)$;
 - b. $P(C|A)$;
 - c. $P(B \text{ and } C)$; and
 - d. $P(C|B)$.

2. Given that three events A, B, and C with probabilities:
 $P(A) = 0.21$, $P(B) = 0.15$, $P(C) = 0.40$,
 $P(B \text{ and } C) = 0.0225$, $P(A \text{ or } C) = 0.40$, $P(A \text{ and } B \text{ and } C) = 0$
 - a. Are events A, B, and C collectively exhaustive?
 - b. Are events B and C statistically independent?
 - c. Are events A and C mutually exclusive?
 - d. Present the three events in Venn Diagram presentation roughly.

3. Friendly Department Store has been the target of many shoplifters during the past month, but owing to increased security precautions, 250 shoplifters have been caught. Each shoplifter's sex is noted; also noted is whether the perpetrator was a first-time or repeat offender. The data are summarized in the table below;

Sex	First-Time Offender	Repeat Offender
Male	77	55
Female	33	85

Assuming that a shoplifter is chosen at random, find:

- a. the probability that the shoplifter is male.
- b. the probability that the shoplifter is a first-time offender, given the shoplifter is male.
- c. the probability that the shoplifter is female, given that the shoplifter is a repeat offender.
- d. the probability that the shoplifter is female, given that the shoplifter is first-time offender.
- e. the probability that the shoplifter is both male and a repeat offender.

Seminar 15 (cont.)

4. An independent research group has been studying the chances that an accident at a nuclear power plant will result in radiation leakage. The group considers that the only possible types of accidents at a reactor are fire, material failure, and human error, and that 2 or more accidents never occur together. It has performed studies that indicate that if there were a fire, a radiation leak would occur 20 percent of the time; if there were a mechanical failure, a radiation leak would occur 50 percent of the time; and if there were a human error, a radiation leak would occur 10 percent of the time. Its studies has also shown that the probability of:
- A fire and a radiation leak occurring together is 0.0010.
 - A mechanical failure and a radiation leak occurring together is 0.0015
 - A human error and a radiation leak occurring together is 0.0012.
- a. What are the respective probabilities of a fire, mechanical failure, and human error?
 - b. What is the probability of a radiation leak?
 - c. What are the respective probabilities that a radiation leak was caused by a fire, mechanical failure, and human error?
5. The probability that a person has a certain disease is 0.03. Medical diagnostic tests are available to determine whether the person actually has the disease. If the disease is actually present, the probability that the medical diagnostic test will give a positive result (indicating that disease is present) is 0.90. If the disease is not actually present, the probability of a positive result (indicating the disease is present) is 0.02.
- a. What proportion of medical diagnostic tests are positive?
 - b. Suppose that the medical diagnostic test has given a positive result. What is the probability that the disease is actually present?
 - c. Suppose that the medical diagnostic test has given a negative result. What is the probability that the disease is not present?