CEE110
Homework #2

There are a total of 6 problems. You must show all work for full credit.

1. Seventy percent of the light aircraft that disappear while in flight in a certain country are subsequently discovered. Of the aircraft that are discovered, 60% have an emergency locator, whereas 90% of the aircraft not discovered do not have such a locator. Suppose a light aircraft has disappeared.

a. If it has an emergency locator, what is the probability that it will not be discovered?

b. If it does not have an emergency locator, what is the probability that it will be discovered?

2. A batch of 140 semiconductor chips is inspected by choosing a sample of 5 chips. Assume 10 of the chips do not conform to customer requirements.

a. How many different samples are possible?

b. How many samples of five contain exactly one nonconforming chip?

c. Any samples of five contain at least one nonconforming chip?

3. In the laboratory analysis of samples from a chemical process, five samples from the process are analyzed daily. In addition, a control sample is analyzed twice each day to check the calibration of the laboratory instruments.

a. How many different sequences of process and control samples are possible each day? Assume that the five process samples are considered identical and that the two control samples are considered identical.

b. How many different sequences of process and control samples are possible if we consider the five process samples to be different and the two control samples to be identical?

c. For the same situation as part (b), how many sequences are possible if the first test of each day must be a control sample?

4. In a chemical plant, 24 holding tanks are used for final product storage. Four tanks are selected at random and without replacement. Suppose that six of the tanks contain material in which the viscosity exceeds the customer requirements.

a. What is the probability that exactly one tank in the sample contains high-viscosity material?

b. What is the probability that at least one tank in the sample contains high-viscosity material?

c. In addition to the six tanks with high viscosity levels, four different tanks contain material with high impurities. What is the probability that exactly one tank in the sample contains high-viscosity material and exactly one tank in the sample contains material with high impurities?

5. A contractor has two subcontractors for his excavation work. Experience shows that in 60% of the time, subcontractor A was available to do a job, whereas subcontractor B was available 80% of the time. Also, the contractor is able to get at least one of these two subcontractors 90% of the time.

a. What is the probability that both subcontractors will be available to do the next job?

b. If the contractor learned that subcontractor A is not available for the job, what is the probability that the other subcontractor will be available?

c. Suppose E_A denotes the event that subcontractor A is available, and E_B denotes that subcontractor B is available.
Are E_A and E_B independent? Justify your answer.
Are E_A and E_B mutually exclusive? Justify your answer.
Are E_A and E_B collectively exhaustive? Justify your answer.

6. The probability of a severe fire (denoted event F) occurring on campus is assumed to be low. The insurance company estimates that the probability of a fire occurring in a year is 0.01. However, for additional safety, a very sensitive fire alarm system was installed. This system will always sound an alarm (A) whenever there is a fire; but because of its high sensitivity, it may also cause false alarms with a probability of $P(A|F^c)=0.1$. Assume that there is no possibility for more than one fire in a year.

a. List the set of mutually exclusive and collectively exhaustive events.

b. Calculate the probabilities for each of the events listed in (a).

c. What is the probability that the alarm system will be triggered in one year?

d. What is the probability of a real fire given that the alarm sounded?