

CEE110
Homework #2

You must show all work for full credit. Submit your homework through Gradescope.

Problem 1.

A sample of 5 memory chips was randomly selected from a batch of 140 memory chips and inspected. Suppose 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?

Problem 2.

There are 15 solid-state drives (SSD), of which 5 are 1 TB, 6 are 2 TB, and 4 are 3 TB. Suppose that three of these SSDs are randomly selected.

- a. What is the probability that exactly two of the selected SSDs are 3 TB?
- b. What is the probability that all three of the SSDs have the same storage?
- c. What is the probability that one SSD of each storage is selected?

Problem 3.

There are 24 water treatment plants and assume that six of the plants discharge water that exceeds the water quality standards. Four plants are selected at random and without replacement.

- a. What is the probability that exactly one plant in the sample exceeds the standards?
- b. What is the probability that at least one plant in the sample exceeds the standards?
- c. In addition to the six plants exceeding the standards, four different plants discharge water with high turbidity. What is the probability that exactly one plant in the sample exceeds the standards for lead and exactly one plant in the sample discharges water with high turbidity?

Problem 4.

A Covid-vaccine experiment shows that in 60% of the time, vaccine A produced antibodies, whereas vaccine B did 80% of the time. Also, at least one of these two vaccines works 90% of the time.

- a. What is the probability that both vaccines will produce antibodies?
- b. If vaccine A is not working, what is the probability that the other vaccine will work?
- c. Suppose V_A denotes the event that vaccine A work, and V_B denotes that vaccine B work. Are V_A and V_B independent? Justify your answer.
- d. Are V_A and V_B mutually exclusive? Justify your answer.
- e. Are V_A and V_B collectively exhaustive? Justify your answer.

Problem 5.

A fire at UCLA campus is rare and the probability of a fire occurring in Boelter Hall in a year is 0.01. A fire alarm system will always sound an alarm whenever there is a fire; but because of its high sensitivity, it may also cause false alarms with a probability of 0.1. Assume that there is no possibility for more than one fire in a year. Denote F for fire and A for alarm goes off.

- a. List the set of mutually exclusive and collectively exhaustive events in this case using F and A .
- b. Draw the tree diagram. What are the probabilities for each of the events listed above?
- c. What is the probability that the alarm system will go off in one year?
- d. What is the probability of an actual fire given that the alarm went off?

Problem 6.

A valve is given a quality score of either A, B or C. 20% of the valves were given a quality score A, 30% were given a quality score B, and 50% were given a quality score C. In addition, 3% of the valves given a quality score A eventually failed, and the failure rate was 4% for valves given quality score B, and 5% for valves given a quality score C.

- a. Draw a tree diagram and show the probability for each outcome.
- b. What is the probability that the valve will fail?
- c. If the valve fails, what is the probability that its quality score is either B or C?
- d. If the valve does not fail, what is the probability that its quality score is A?
Round the values to the nearest hundredth if needed.