ECI114: Probabilistic Systems Analysis for Engineers

HW # 2, Due: 28Apr2023, by midnight on Canvas.

Problem:

1. An assembly consists of three mechanical components. Suppose that the probabilities that the first, second, and third components meet specifications are 0.95, 0.98, and 0.99, respectively. Assume that the components are independent. Determine the probability mass function of the number of components in the assembly that meet specifications.

2. Assume that each of your calls to a popular radio station has a probability of 0.02 of connecting, that is, of not obtaining a busy signal. Assume that your calls are independent.

   - What is the probability that your first call that connects is your 10th call?
   - What is the probability that it requires more than five calls for you to connect?
   - What is the mean number of calls needed to connect?

3. Customers visit a Web site, and the probability of an order if a customer views five or fewer pages is 0.01. However, if a customer views more than five pages, the probability of an order is 0.1. The probability a customer views five or more pages is 0.25. The customers behave independently.

   - Is the number of customers who visit the site until an order is obtained a geometric random variable? Why or why not?
   - What is the probability that the first order is obtained from the 10th customer to visit the site?

4. The probability density function of the net weight in pounds of a packaged chemical herbicide is $f(x) = 2.0$ for $49.75 < x < 50.25$ pounds.

   - Determine the probability that a package weighs more than 50 pounds.
   - How much chemical is contained in 90% of all packages?

5. The probability density function of the time you arrive at a terminal (in minutes after 8:00A.M.) is $f(x) = 0.1e^{(-0.1x)}$ for $0 < x$. Determine the probability that

   - You arrive by 9:00 A.M.
   - You arrive between 8:15 A.M. and 8:30 A.M.
   - You arrive before 8:40 A.M. on two or more days of five days. Assume that your arrival times on different days are independent.
   - Determine the cumulative distribution function and use the cumulative distribution function to determine the probability that you arrive between 8:15 A.M. and 8:30 A.M.