Assignment #2 – The Normal Distribution

1. Assume that the current measurements in a strip of wire follow a normal distribution with a mean of 10 milliamperes and a variance of 4 (milliamperes)^2.
   a. What is the probability that a measurement exceeds 13 milliamperes?
   b. What is the probability that a current measurement is between 9 and 11 milliamperes?

2. Assume that in the detection of a digital signal the background noise follows a normal distribution with a mean of 0 volt and standard deviation of 0.45 volt. The system assumes a digital ‘1’ has been transmitted when the voltage exceeds 0.9. What is the probability of detecting a digital ‘1’ when none was sent?

3. In a production facility, the thickness of a sheet is normally distributed with a mean of 2.02 mm and a standard of 0.02 mm. The specifications on the sheet are 2.00±0.05 mm. What proportion of sheets will be rejected? Suggest a way to reduce the rejects.

4. The sick-leave time of employees in a firm in a month is normally distributed with a mean of 100 hours and a standard deviation of 20 hours.
   a. What is the probability that the sick-leave time for next month will be between 50 and 80 hours?
   b. How much time should be budgeted for sick leave if the budgeted amount should be exceeded with a probability of only 10%?

5. The weight of a sophisticated running shoe is normally distributed with a mean of 12 ounces and a standard deviation of 0.5 ounce.
   a. What is the probability that a shoe weighs more than 13 ounces?
   b. What must the standard deviation of weight be in order for the company to state that 99.9% of its shoes are less than 13 ounces?
   c. If the standard deviation remains at 0.5 ounce, what must the mean weight be in order for the company to state that 99.9% of its shoes are less than 13 ounces?
Normal Approximations

6. The probability that a delivery arrives on time is 0.7. What is the probability that more than 20 of the next 25 deliveries arrive on time? Solve using both the original distribution and the normal approximation and compare the results.

7. A high-volume printer produces minor print-quality errors on a test pattern of 1000 pages of text according to a Poisson distribution with a mean of 0.4 per page. What is the probability that more than 350 pages contain errors? Solve using both the original distribution and the normal approximation and compare the results.

8. Assume that the number of asbestos particles in a squared meter of dust on a surface follows a Poisson distribution with a mean of 1000. If a squared meter of dust is analyzed, what is the probability that less than 950 particles are found? Solve using both the original distribution and the normal approximation and compare the results.

9. The percentage of people exposed to a bacteria who become ill is 20%. Assume that people are independent. Assume that 1000 people are exposed to the bacteria. Approximate each of the following:
   a. The probability that more than 225 become ill
   b. The probability that between 175 and 225 become ill
   c. The value such that the probability that the number of people that become ill exceeds the value is 0.01
      Do we need a continuity correction in parts a and b above?