INEG 2313: Applied Probability and Statistics for Engineers I
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Drill 6
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1. Suppose the probability density function of the random variable *X* is

$$F_X(x) = \begin{cases} 0.2 & 0 < x < 5 \\ 0 & otherwise \end{cases}$$

Determine the variance of X.

2. An e-mail message will arrive at a time uniformly distributed between 9:00 A.M. and 11:00 A.M. You check e-mail at 9:15 A.M. and every 30 minutes afterward.
a) Determine the probability density function of the time an e-mail message arrives (in minutes).

b) Using the pdf developed in (a), derive the CDF.

c) Determine the mean of arrival time.

d) What is the standard deviation of arrival time (in minutes)?

e) What is the probability that the message arrives less than 10 minutes before you view it?

f) What is the probability that the message arrives more than 15 minutes before you view it?

3. A professor commutes daily from her suburban home to her campus office. The average time for a one-way trip is 24 minutes, with a standard deviation of 3.8 minutes. Assume the distribution of trip times to be normally distributed.

a) Sketch the probability density function of X.

b) What is the probability that a trip will take at least ½ hour?

c) If the office opens at 9:00 am and she leaves her house at 8:45 am daily, what percentage of the time is she on time for work?

d) If she leaves the house at 8:35 am and coffee is served at the office from 8:50 am until 9:00 am, what is the probability that she arrives at the office while coffee is being served?

e) Find the length of time x such that 15% of her trips take more than x minutes.

4. In the manufacture of electroluminescent lamps, several different layers of ink are deposited onto a plastic substrate. The thickness of these layers is critical if specifications regarding the final color and intensity of light of the lamp are to be met. Let X and Y denote the thickness of two different layers of ink. It is known that X is normally distributed with a mean of 0.1 millimeter and a standard deviation of 0.00031 millimeter and Y is also normally distributed with a mean of 0.23 millimeter and a standard deviation of 0.00017 millimeter. Assume that these variables are independent.

a) If a particular lamp is made up of these two inks only, what is the mean and standard deviation of the total ink thickness?

b) What is the probability that the total ink thickness is less than 0.2337 millimeter?

5. Suppose L and W represent the length and width of a rectangle. L is a normal random variable with an expected value of 5 inches and a variance of 0.5 inches. W is a normal random variable with an expected value of 10 inches and variance of 2 inches.

a) What is the expected perimeter of the rectangle?

b) What is the perimeter's variance?