Chapter 7 Problems 18, 19, 22

7.16 Exercise 18

Given an exponentially distributed population with mean 216.24. Determine the probability of a random selected item having a value between 461.1 and 485.8. (Six Sigma Study Guide 2002)

- $F(x)=1-e^{-x/\theta} = 1-e^{-461.1/216.24} = 0.88144$
- $F(x)=1-e^{-x/\theta} = 1-e^{-485.8/216.24} = 0.89424$
- 0.89424-.88144=.01280

7.17 Exercise 19

Determine the probability that a randomly selected item from a population having a Weibull distribution with shape parameter of 1.6 and a scale parameter of 117.1 has a value between 98.1 and 99.8. (Six Sigma Study Guide 2002)

	Description	Response
1	Determine the percentage having a value less than 99.8	53.9%
2	Determine the percentage having a value less than 98.1	52.9%
3	Subtract the two percentages	1%

Use of the following relationship

$$F(x)=1-\exp\left[-\left(\frac{x}{k}\right)^{b}\right]$$

yields: .538981-.529199 = 0.01

7.20 Exercise 22

A complex software system averages 6 errors per 5,000 lines of code. Determine the probability of less than 3 errors in 2,500 lines of randomly selected lines of code. Determine the probability of more than 2 errors in 2,500 lines of randomly selected lines of code. (Six Sigma Study Guide 2002)

The average number of errors in 2,500 lines of code is $\mu = 3$. The probability of less than 3 defects is equal to the probability of exactly 0 defects plus the probability of exactly 1 defect plus the probability of exactly 2 defects. This value can be computed manually; however, the same solution is found using the Excel formula

=POISSON(2,3,1)

The "1" at the end of this formula gives the cumulative Poisson.

The probability of more than 2 errors is equal to the probability of exactly 3 plus the probability of exactly 4 plus the probability of exactly 5, etc.

A simpler approach is to consider that the probability of more than 2 errors is equal to one minus the probability of 2 or fewer errors. Thus, the probability of more than 2 errors is 1 - 0.4232 = 0.5768.

$\lambda = 6 \text{ errors}/5000 \text{ lines of code} = 3 \text{ errors per } 2500 \text{ lines of code}$

P(x>2) = 1-(P<3) = 1-P(x=0) –P(x=1)-P(x=2)

$$P(0) = \frac{e^{-3}3^0}{0!} = 0.050$$

$$P(1) = \frac{e^{-3}3^1}{1!} = 0.149$$

$$P(2) = \frac{e^{-3}3^2}{2!} = 0.224$$

P(x>2) = 1-(P<3) = 1-0.050 –0.149 -0.224 =.5768