Statistics   **Worksheet #2**
Unit 7.2   **Poisson Probability Distribution**

1) If the random variable follows a Poisson distributions with a mean of 3.4, find the probability that $r = 6$.

2) Given a binomial experiment with n = 200 trials and probability of success on a single trial p = .04, find the value of λ and then use the Poisson distribution to estimate the probability of r = 8 successes.

3) Given a binomial experiment with n = 150 trials and probability of success on a single trial p = .06, find the value of λ and then use the Poisson distribution to estimate the probability of r ≤ 8 successes.

4) At Burnt Mesa Pueblo, in one of the archaeological excavation sites, the artifact density (number of prehistoric artifacts per 10 liters of sediment) was 1.5. Suppose you are going to dig up and examine 50 liters of sediment at this site. Let r = 0, 1, 2, 3, ... be a random variable that represents the number of prehistoric artifacts found in your 50 liters of sediment.

    a) Explain why the Poisson distribution would be a good choice for the probability distribution of r. What is λ? Write out the formula for the probability distribution of the random variable r.

    b) Compute the probabilities that in 50 liters of sediment you will find two prehistoric artifacts, three prehistoric artifacts, and four prehistoric artifacts.

    c) Find the probability that you will find three or more prehistoric artifacts in the 50 liters of sediment.

    d) Find the probability that you will find fewer than three prehistoric artifacts in the 50 liters of sediment.

5) In his doctoral thesis, L.A. Beckel studied the social behavior of river otters during the mating season.. An important role in the bonding process of river otters is very short periods of social grooming. After extensive observations, Dr. Beckel found that one group of river otters under study had a frequency of initiation grooming of approximately 1.7 for every 10 minutes. Suppose that you are observing river otter for 30 minutes. Let r = 0, 1, 2, ... be a random variable that represents the number of times in a 30 minute interval one otter initiates social grooming of another.

      a) Explain why the Poisson distribution would be a good choice for the probability distribution of r. What is λ? Write out the formula for the probability distribution of the random variable r.

      b) Find the probabilities that in you 30 minutes of observation, one otter will initiate social grooming four times, five times, and six times.

      c) Find the probability that one otter will initiate social grooming four or more times during the 30 minute observation period.

      d) Find the probability that one otter will initiate social grooming fewer than four times during the 30 minute observation period.

6) The Denver Post reported that, on average, a large shopping center has had an incident of shoplifting caught by security once every three hours. The shopping center is open from 10am to 9pm. Let r be the number of shoplifting incidents caught by security in the 11 hour period during which the center is open.

      a) Explain why the Poisson distribution would be a good choice for the probability distribution of r. What is λ?

      b) What is the probability that in the 11 hour period there will be at least one shoplifting incident caught by security?

      c) What is the probability that in the 11 hour period there will be at least three shoplifting incidents caught by security?

      d) What is the probability that in the 11 hour period there will be no shoplifting incidents caught by security?

7) USA Today reported that the U.S. annual birthrate is 16 per 1000 people, and the death rate is 8 per 1000 people.

　　　a) In a community of 1000 people, what is the annual probability of 10 births? What is the probability of 10 deaths? What is the probability of 16 births? 16 deaths?

　　　b) Repeat part (a) for a community of 1500 people. You will need to use a calculator to compute P(10 births) and P(16 births).

　　　c) Repeat part (a) for a community of 750 people.

8) The number of industrial injuries per working week in a particular factory is known to follow a Poisson distribution with mean 0.5.

　　　a) Find the probability that there will be less than 2 accidents in a particular week.

　　　b) Find the probability that there will be more than 2 accidents in a particular week.

　　　c) Find the probability that there will 0 accidents in a three – week period.

9) The number of misprints on a page of the Daily Mercury has a Poisson distribution with an average of 1.2. Find the probability that the number of errors:
　　　a) on page four is 2

　　　b) on page three is 3.

　　　c) on page ten is less than 2.

　　　d) on page forty is more than 1.