**KEY**

**Question 1.** The Birdwatchers of America are interested in the populations of bird species common to Western Oregon (data are in Lab4\_SkillsData.csv). For one day, they set up a station and counted the number of American robins, black-capped chickadees and barn swallows that were observed each hour.

1. One of the questions the birdwatchers are interested in is the number of total birds observed in a unit of time. What discrete distribution would you use for analysis?

You would use a Poisson distribution.

1. What is the expected number of total birds one would see during an hour of bird watching?

setwd("G:/My Drive/QSCI381/Lab 4") # change setwd() as needed

birds <- read.csv("Lab4\_SkillsData.csv",header=T)

mean(birds$Total.Birds)

On average, one would expect to see 4.625 birds during an hour of bird watching.

1. What is the probability that in any given hour 6 birds will be observed? Calculate this probability using both the Poisson probability formula and dpois().

(exp(-4.625)\*(4.625^6))/factorial(6)

dpois(6, 4.625)

The probability that in any given hour 6 birds will be observed is 0.133.

1. What is the probability that you would observe more than 4 birds in any given hour? Calculate this probability using both dpois() and ppois().

1-sum(dpois(0:4, 4.625))

1-ppois(4, 4.625)

The probability that in any given hour 6 birds will be observed is 0.491.

1. Suppose on average you see 2.167 barn swallows and 1.125 American robins per hour. What is the probability that you see 2 or fewer barn swallows *or* exactly 1 robin in any given hour? Assume that the numbers of swallows and robins are independent.

You would use the additive rule P(A or B) = P(A) + P(B) – P(A and B)

Because swallow and robin numbers are independent, P(A and B) = P(A)\*P(B).

ppois(2, 2.167)\*dpois(1, 1.125) # P(<2 swallows and exactly 1 robin)

ppois(2, 2.167) + dpois(1, 1.125) - ppois(2, 2.167)\*dpois(1, 1.125) # P(<2 swallows or exactly 1 robin)

The probability of seeing 2 or fewer barn swallows or exactly 1 robin in any given hour is 0.766.

**Question 2.** Recall that the birdwatchers observed birds each hour for one day (24 hours). They want to know whether or not a black-capped chickadee was observed each hour.

1. What discrete distribution would you use for this analysis?

You would use a binomial distribution for this analysis.

1. What proportion of the hours do the observers see a chickadee?

sum(birds$Black.capped.chickadee > 0)/24

Observers see a chickadee in 75% of the hours.

The observers go back into the field a separate day for 8 hours and record whether they see chickadees each hour.

1. Find the mean, variance, and standard deviation for the number of hours in which chickadees will be seen.

8\*0.75 # mean

8\*0.75\*(1-0.75) # variance

sqrt(8\*0.75\*(1-0.75)) # standard deviation

The mean number of hours in which chickadees will be seen is 6. The variance for the number of hours is 1.5 and the standard deviation is 1.224.

1. What is the probability within that second, 8-hour observation day that there will be exactly 7 hours in which they observe chickadees? Calculate this probability using both the binomial probability formula and dbinom().

choose(8,7)\*(0.75^7)\*((1-0.75)^(8-7))

dbinom(7,8,0.75)

The probability of having exactly 7 hours in which they observe chickadees is 0.267.