

## BIOMETRY, CLASS EXERCISE 7

(1) Blue-spotted salamanders are native to Quebec. They are terrestrial as adults however they return to water to breed and lay their eggs. Breeding occurs in early spring. They generally move into snow-melt ponds like those used by wood frogs, and in small permanent ponds that are free of fish. The female can lay up to 200 eggs and within 3-4 weeks the eggs hatch.



A previous study has established that 74% of female blue-spotted salamanders breed successfully in a certain area of Eastern Quebec. You have picked 12 female blue-spotted salamanders from this area at random and your observations show that 6 of them have bred successfully. According to the historical model how likely is that only 6 out of 12 female blue-spotted salamanders would have bred successfully? Is this event statistically significant?

(2) Secretarybirds are very large, mostly terrestrial birds of prey endemic to Africa. Secretarybirds associate in monogamous pairs. In the savannah of a sub-Saharan region the density of Secretarybird pairs is 2.3 pairs per  $100km^2$ . You surveyed an area of  $200km^2$  and found 6 pairs of secretarybirds. What is the probability of this happening at random? Is this event statistically significant?



(3) Dandelions are very persistent weed species in my backyard. Despite the best efforts of the groundhog residing under the shed to devour them all, the dandelions bloom in the early spring all over the place. On a mid-April day, a measurement in 12 randomly selected quadrats of  $1m^2$  found the following number of blooming dandelions:



Number of dandelions	0	1	2	3	4
Frequency	1	3	4	2	2

Let's test the hypothesis that the number of dandelions per  $1m^2$  quadrat follows the Poisson distribution.

- a) Compute the sample average  $\bar{x}$ .
- b) Combine the cells with counts smaller than 3 so that every cell has a count of at least 3.
- c) Under the assumption that the data is Poisson distributed compute the probabilities for each (combined) cell.
- d) Compute the expected counts in the cells.
- e) Compute the  $\chi^2$  statistic.
- f) Look up the  $p$ -value in the table (or via Excell).
- g) Is the Poisson distribution a good fit for the dandelion count data?
- h) If Poisson is a good fit for this data, compute the probability for finding 5 blooming dandelions in a quadrat. Is this result statistically significant? Does this indicate that the groundhog visits this quadrat less frequently than on average?