

Biometry, H19, Test 2

Name: _____

Student number _____

1. (3 marks) Northern cardinals mate for life and stay together year-round. In the spring the male brings nest material to the female, who does the nest building. It takes on average 5.4 days to build a nest. Compute the the probabilities that a Northern cardinal pair will build their nest in 4, in 5, in 6 and in 7 days.

2. (3 marks) A northern cardinal pair raises two to three, and sometimes even four broods each year. Three or four eggs are laid in each clutch. The survival rate for the first 12 months of juvenile Northern cardinals is 22%. A Northern cardinal pair had nine chicks within the last year. Compute the probabilities that 0, 1, 2 or 3 of the chicks will survive the first 12 months.

3. (3 marks) *Agelenopsis aperta* is a sheet-web weaving spider found in the grasslands of the desert southwestern US. These spiders build sheet webs that resemble funnels. A very small amount of the habitat is suitable for websites and, of course, that is where the spiders are, clumping in spots. The number of spiders per $25m^2$ is distributed according to the negative binomial distribution with mean $\mu = 1.2$ and $k = 3.4$ where $1/k$ is the clumping parameter. Compute the probabilities for finding 0, 1, 2 and more than 2 spiders in $25m^2$.

4. (4 marks) Gaétan is a retired electrician living in the suburbs, spending large amounts of time tending to his lawn. Broadleaf plantain is a persistent weed and to study the problem Gaétan carefully counted the number of broadleaf plantain plants per quadrat in 60 quadrats in his lawn. The results are as follows

Number of plants	0	1	2	≥ 3
Number of quadrats	15	21	15	9

- a) Fit a Poisson distribution model on this data. Make sure to perform a χ^2 goodness-of-fit test to evaluate the suitability of the model. Report a p -value for the test.
- b) If the model is adequate compute the probability that Gaétan will find five broadleaf plantain plants in a quadrat in his lawn. Is this event statistically significant?

5. (2 marks) Sequoioideae, popularly known as Redwoods, are most common in the coastal forests of Northern California. The numbers of redwood trees in 7 randomly selected $100m^2$ patches were counted by a park ranger as follows.

4 4 5 2 4 3 6

Compute the coefficient of dispersion. Based on this data are the redwood trees distributed regularly, randomly or are they clumped? After you have given your answer, give a biological explanation for the type of distribution observed.

6. (3 marks) Northern cardinal nests are on average 10.1cm across with a standard deviation of 1.3cm . Assume these sizes are normally distributed.
- a) What is the probability that a randomly selected northern cardinal nest is more than 13cm across? Is this event statistically significant?
 - b) What is the probability that a randomly selected northern cardinal nest is between 10cm and 13cm across?

7. (3 marks) The average wingspan of American robins is 36.0cm with standard deviation of 2.7cm . Assuming that the wingspan is normally distributed compute the wingspans which correspond to the top 1% and the bottom 1% of the distribution.