BIOMETRY, HOMEWORK 2

(Critical probability) Critical probability questions: is an event statistically significant, statistically highly significant, statistically very highly significant will be integrated in one or more problems from the categories below.

(1) (Binomial distribution) The distribution of blood types varies significantly by region of the world consequently by country. In Liechtenstein 37% of the natives have blood type A+. Consider a group of 5 randomly selected Liechtenstein natives. Fill in a probability table for the number of A+ persons in the group of 5.

(2) (Poisson distribution) How many deer do wolves kill? A 2013 study of grey wolves in Minnesota found that grey wolves kill on average 1.6 adult-sized deer per wolf per month. Compute the probabilities that a lone wolf will kill and consume 0, 1, 2 and more than 2 deer in a month.

(3) (Negative binomial distribution) Valerie has 22% chance of catching rainbow trout in Riviere-du-Nord on any of her fishing expeditions. What is the expected number of failures before Valerie catches trout for a forth time and what is the standard deviation? Also, compute the probability that there will be only 10 failures before Valerie catches her fourth trout.

(4) (Goodness of fit test) You have been assigned to study the proportion of Rhesus factor positive persons in Québec. You have been given access to blood collection data from many locations in the province. To obtain an estimate you selected groups of 4 randomly selected test results from 100 blood collection locations. The frequncy table detailing the number of Rh+ persons in your samples of 4 are as follows:

Rh+	0	1	2	3	4
Frequancy	0	4	10	38	48

Determine if the binomial distribution is a good fit for this data witn a χ^2-goodness of fit test. What is the probability that a random person in Québec is Rh positive according to your model? In a random sample of 3 Quebecers you found no Rh+ persons. Is this event unlikely?

(5) (Goodness of fit test) The number of birds caught for banding in a reserach station per day for 400 days is summarized in the following frequency table:

Number of birds caught	0	1	2	3	4
Frequency	211	128	36	20	5

Determine if the Poisson distribution is a good fit for this data using a χ^2-goodness of fit test? If the Poisson distribution does not fit, which distribution would you suggest instead? (Do not compute for this new suggestion.)

(6) (Dispersion) During the dry seson in an wildlife African reserve the number of leopards was counted for 7 areas of $100km^2$. The results are as follows

$$2 \quad 9 \quad 0 \quad 10 \quad 8 \quad 0 \quad 1$$

Compute the coefficient of dispersion. The population is clumped; can you explain why?

(7) (Test for independence). (Ignore, will be moved to HW3!) For devotees of Star Trek a question of fundamental interest is if fatality rates and uniform color are independent. The table below summarizes the fatality and survivor numbers in one the Star Trek episodes.

	Blue	Gold	Red
Dead	7	9	24
Alive	129	46	215

Use a χ^2 test for independence to test the hypothesis that fatality rates and uniform color are independent at the 5% level of significance. Make sure to report a p-value and draw a conclusion in the context of the problem.