

Biometry, H20, Test 1

Name: _____

Student number _____

1. (3 marks) Arctic foxes have the largest litter size in the order Carnivora with up to 25 kits in a litter. You are dispatched to the area of Fort Severn in Northern Ontario to study one of the most southern arctic fox populations. In the eight litters you found the number of kits was

13 11 9 6 10 6 11 18

Compute the mean, the standard deviation and the coefficient of variation of arctic fox litter sizes in Northern Ontario.

2. (2 marks) In Northern Ontario the arctic foxes are under intense pressure from red fox populations who steadily expand their range further and further North. A multi-year study contains the following data on red fox litter sizes in Northern Ontario:

Litter size	Frequency
[3, 4]	14
[5, 6]	29
[7, 8]	57
[9, 10]	41
[11, 12]	19

Compute the sample mean litter size.

3. (3 marks) Despite being alarmingly cute arctic foxes are vicious predators. Observations from 27 adult arctic foxes show the following rates of goose eggs acquired per hour (more than 85% of the eggs are stored for future consumption):

4.5 6.6 5.9 4.5 6.9 3.6 7.4 5.3 6.3

5.5 6.1 4.9 6.8 5.9 7.2 7.0 7.3 6.8

4.4 6.2 5.4 4.0 5.9 7.0 4.6 6.1 4.7

Organize the data into a frequency table with five classes. Draw a histogram based on this frequency table.

4. (3 marks) i) In the last five years the population of red foxes in Wapusk National Park has experienced growth of 2%, 6%, 6%, 12% and 21% respectively. If initially there were 30 red foxes in the Park, how many red foxes were there after one year, after two years, after three years, after four years and after five years (round to integers)? What is the average yearly growth rate over the five years?
- ii) During the same five years the population of arctic foxes in Wapusk National Park has had growth rates of 2%, 1%, 0%, -3%, -16%. If initially there were 420 arctic foxes in the Park, how many arctic foxes were there after one year, after two years, after three years, after four years and after five years (round to integers)? What is the average yearly growth rate over the five years?

5. (1 mark) Working for Parks Canada you have been tasked with banding a sample of adult Atlantic Puffins in the Mingan Archipelago and also with measuring and recording the weights and the wingspans of the Puffins in the sample. The weights of adult Atlantic Puffins are in the range from 470g to 515g. With what precision should you measure the weights? Explain.

6. (2 marks) The smallest Atlantic Puffin you caught and measured has a weight of 483g and the largest one had a weight of 508g. Compute the relative errors of these measurements.

7. (3.5 marks) You are visiting Belize and the bugs are starting to get to you. In revenge you decide to accumulate data about the presence of the four of the nastiest bugs at your two camps, the first one inland and the second one near a river. Here is a table detailing how many times you got bitten by each of these bugs at your two camps:

Bug	Inland	River
Mosquitoes	22	79
Sandflies	30	110
Botlass flies	32	9
Doctor flies	22	6

Consider selecting a random bug bite. Consider the following events: $M = \{\text{Mosquito bite}\}$, $S = \{\text{Sandfly bite}\}$, $B = \{\text{Botlass bite}\}$, $D = \{\text{Doctor fly bite}\}$, $I = \{\text{Inland}\}$, $R = \{\text{River}\}$. Compute the following probabilities.

a) $p(M)$, b) $p(S^c)$, c) $p(S \cap R)$, d) $p(S \cup I)$, e) $p(M|I)$, f) $p(M|I^c)$.

By comparing unconditional with conditional probabilities argue that the distributions of bugs depends on the location.

8. (2.5 marks) The Atlantic puffin and other pelagic birds are excellent bioindicators of the environment, as they occupy a high trophic level. Heavy metals and other pollutants are concentrated through the food chain, and as fish are the primary food source for Atlantic puffins, the potential is great for them to bioaccumulate heavy metals such as mercury. Studies show that 55% of Atlantic Puffins have elevated levels of Mercury. It is known that if a female Puffin has elevated levels of mercury the eggs she lays have 75% chance of not hatching. 88% of the eggs of healthy Puffins will hatch.
- i) An Atlantic Puffin egg will not hatch. What is the probability the female Puffin who laid this egg has elevated levels of Mercury.
- ii) Another Atlantic Puffin egg has hatched. What is the probability the female Puffin has elevated levels of Mercury nethertheless.