BIOMETRY, HOMEWORK 1

(1) (Measurement precision) Working for Sépaq you have been tasked with collecting a sample of Arctic Char from Lake Pingualuit and measuring and recording the weights of the fish in the sample. The weights of Arctic Char are in the range from 1kg to 9 kg. With what precision should you measure the weights? Explain.

(2) (Relative error) The smallest Arctic Char you caught and measured has a weight of 1.4kg and the largest one had a weight of 8.7kg. Compute the relative errors of these measurements.

(3) (Grouping data, frequency table, histogram) The weights of all 24 Artic Char you caught and measured are recorded below:

2.5	7.6	5.5	6.5	4.9	8.6	5.0	6.3
3.5	3.6	5.9	6.8	2.9	8.7	7.0	4.3
4.5	5.6	1.4	8.0	5.9	6.0	5.8	2.3

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

(4) (Mean, satndard deviation and coefficient of variation) You have been following the bobcats in a certain area in the Laurentians for more than a decade. The life spans (in years) of a sample of eight bobcats from this area are

5.2 7.6 5.5 6.8 5.9 8.6 10.0 12.4

Compute the average, the standard deviation and the coeffcient of variation for the lifespans of the bobcats in this sample.

(5) (Weighted average) You have been assigned to study the infestation of black-legged deer ticks amongst the deer population in the Estrie region. With the help of a team you carefully comb through the fur of a sample of deer and find the following results

Number of ticks	0	1	2	3	4
Number of deer	52	32	12	20	4

Compute the average number of ticks per deer in your sample.

(6) (Geometric mean) The population of bobcats you are tracking in the Laurentians had the following growth rates over the last seven years: 3%, 2%, 8%, 1%, 0%, -3%, 4%. What was the average growth rate of this population over this period?

(7) (Probability, conditional probability, independence) Park national d'Oka is home to several special status plants. Your team has been tasked with implementing protection measures for these plants in some areas of the park. You have collected data from different areas of the park on the population dynamics of one of these plants as well as their protection status. The data is organized in the contingency table below:

Area population status	Protected	Not Protected
Increasing	24	6
Stable	10	12
Decreasing	8	20

Consider selecting a plant of this type at random. Consider the following events: P = {the plant is an protected area}, NP = {the plant is not protected}, I = {the plant is in an area of increasing population}, S = {the plant is in an area of stable population}, D = {the plant is an area of decreasing population}. Compute the following probabilities and in each case write a sentence explaining their meaning.
a) $p(P)$, b) $p(I)$, c) $p(D^c)$;
d) $p(S \cap P)$, e) $p(D \cap NP)$, f) $p(I \cup P)$;
g) $p(I|P)$, h) $p(P|I)$, i) $p(D^c|P)$.
By comparing unconditional with conditional probabilities argue that protection status and population status are not independent.

(8) (Bayes Rule) Reindeer fawns mostly in May and in June and rarely in April. It is know that only 3% of the reindeer calves are born in April. Of the calves born in April 45% survive their first year while of the calves born in May and June 80% survive their first year. If a calf survived its first year what is the probability it was born in April?