Biometry, H23, Test 2

Name: _____ Student number_____

Patagonia is a geographical region that encompasses the southern end of South America. The region comprises the southern section of the Andes Mountains with lakes, fjords, temperate rainforests, and glaciers in the west and deserts, tablelands and steppes to the east.

1. (3.5 marks) The South American cougar (Puma concolor), also known as puma, is a cougar subspecies occurring in Patagonia. The cougar preys on a variety of species based on its location, from birds, primates, vicuña, guanaco, deer, tapir, sloths, capybara, agouti, mara and other rodents, frogs, lizards. Sometimes the puma abandons its kills when harassed by Andean condors. In a sample of 814 observations a puma abandoned its kill 368 times when harassed by condors.

    - Construct a 95% confidence interval for the percentage of kills pumas abandon when harassed by condors.
    - Based on this confidence interval can you claim that puma abandon less than 50% of their kills when harassed by condors?

2. (3.5 marks) The guanaco (Lama guanicoe) is a camelid native to Patagonia, closely related to the llama. A wildlife management team has tracked a sample of 49 guanaco for decades. The average sample lifespan of the guanaco in this sample was 21.4 years with standard deviation of 4.3 years. Assume that the lifespan of the guanaco in the population is normally distributed.

   - Construct a 95% and a 98% confidence intervals for the population average lifespan of the guanaco.
   - Write a sentence commenting on the tension between confidence and precision when using confidence interval esimates.

3. (3.5 marks) The South American gray fox (Lycalopex griseus), also known as the Patagonian fox, the chilla or the gray zorro, is a species of Lycalopex, the "false" foxes. The South American gray fox is a largely solitary animal. A study in Argentina of the home ranges of six Patagonian foxes gave the following values in km^2:

   12.0 10.6 8.0 18.4 13.6 11.0

   Assuming that the home range areas is normally distributed compute a 99% confidence interval for the population home range area.

4. (3.5 marks) Humboldt's hog-nosed skunk (Conepatus humboldtii), also known as the Patagonian hog-nosed skunk, is a type of hog-nosed skunk indigenous to the open grassy areas in the Patagonia. Molina's hog-nosed skunk, also called the Andes skunk (Conepatus chinga), is a skunk species from South America. C. humboldtii's and C. chinga's status as separate species is debated.

   A sample of 48 Humboldt's hog-nosed skunks has average weight of $2.2kg$ with standard deviation of $0.5kg$. A sample of 62 Molina's hog-nosed skunks has average weight of $3.4kg$ with standard deviation of $0.7kg$.

   - Determine a 95% confidence interval for the difference of average weights in the two populations assuming equal variances.
   - Based on this confidence interval can you make a claim that the average weights differ?

5. (3.5 marks) The Magellanic tuco-tuco (Ctenomys magellanicus) is a species of rodent in the family Ctenomyidae. It is found in Argentina and Chile. Its natural habitat is subtropical or tropical dry lowland grassland. The population average size of the tuco-tuco is $23.3cm$ with standard deviation of $2.2cm$. Assume the sizes in the tuco-tuco population are normally distributed.

   - Compute the probability that a randomly selected tuco-tuco will have a size latrger than $26cm$.
   - Compute the probability that the average size in a random sample of 12 randomly selected tuco-tuco will be less than $22cm$.
   - Compute the bottom and top 5 percentiles of size in the tuco-tuco population.

6. (3.5 marks) Viscacha are rare rodents of two genera (Lagidium and Lagostomus) in the family Chinchillidae. They are native to South America and convergently resemble rabbits. The plains viscacha (Lagostomus maximus), a resident of the Pampas of Argentina, is easily differentiated from other viscachas by black and gray mustache-like facial markings. This species lives colonially in warrens of 10 to over 100. It is very vocal and emits alarm calls.

   A sample of 52 female viscacha had an average weight of $4.2kg$ with standard deviation of $0.9kg$. A sample of 50 male viscacha had average weight of $6.6kg$ with standard deviation of $2.1kg$.

   - Implement a hypothesis for the difference of weights with the alternative that the males are heavier. Do not presume that the variances are equal.
   - Report a p-value and draw a conclusion in the context of the problem.

7. (3.5 marks) The kodkod (*Leopardus guigna*) is the smallest felid species native to the Americas. It lives primarily in central and southern Chile. Melanistic kodkods with spotted black coats are quite common. The melanistic phenotype is caused by the deletion of a single cysteine residue at position 126 of Agouti-signaling protein. The relative concentration of black eumelanin in a sample of five black kodkods was found to be

   0.42 0.60 0.48 0.40 0.32

   - Assuming that the population relative concentration of black eumelanin is normally distributed test $H_0 : \mu = 0.4$ versus $H_1 : \mu > 0.4$.
   - Report a range for the p-value and draw a conclusion in the context of the problem.

8. (3.5 marks) The Magellanic penguin (Spheniscus magellanicus) is a South American penguin, breeding in coastal Patagonia. Magellanic penguins feed in the water, preying on small pelagic fish, hagfish, cuttlefish, squid, krill, and other crustaceans, and ingest sea water with their prey. Magellanic penguin populations face various pressures, including exposure to reported and unreported oil spills. A sample of seven Magelanic penguins was studied before and after their colony was exposed to an accidental oil spill. The weights (in kg) of these penguins before and after the spill are in the table below.

Before	5.7	4.8	3.7	5.9	4.5	6.2	3.8
After	5.6	4.3	3.8	5.1	4.6	5.8	3.4

Use this data to test $H_0 : d = 0$ against $H_1 : d < 0$. Report a p-value for the test. Here, $d = \mu_2 - \mu_1$. Draw a conclusion in the context of the problem.

9. (3.5 marks) The crested caracara (Caracara plancus) is one of the characteristic objects of a Patagonian landscape. Measurements from seven birds from Tierra del Fuego produced the following values for the length of the wingspan in cm

   130 136 118 124 127 131 122

   - Assuming that the population length are normally distributed test $H_0 : \sigma = 5.0cm$ versus $H_1 : \sigma > 5.0cm$.
   - Report a range for the p-value and draw a conclusion in the context of the problem.

10. (3.5 marks) One of the largest birds in the world, the Andean condor (Vultur gryphus) can be seen in Patagonia. It is believed that the adult Andean condors have a population average wingspan of $2.7m$. A sample of 60 Andean condors had a sample average wingspan of $3.1m$ with sample standard deviation of $0.85m$.

    - Test $H_0 : \mu = 2.7$ versus $H_1 : \mu > 2.7$
    - Compute a p-value for the test and draw a conclusion in the context of the problem.