

BIOMETRY, H24, TEST2

Name: _____

Student number _____

- (1) (3.5 marks) A real estate company estimates that the average house sales price in Mirabel-en-Haut is $430k\$$. Working for the town, you sample the sale prices of 20 houses in Mirabel-en-Haut and find a sample average of $461.88k\$$ with sample standard deviation of $42.125k\$$. Does your data contradict the claim of the real estate agency? Use an appropriate hypothesis test assuming the population distribution of house sale prices is normal. Report bounds for the p -value and make sure to draw a conclusion in the context of the problem.

- (2) (3.5 marks) The time it takes a dandelion flower to turn into a seed head is normally distributed. Gaétan is a horticulturist from Petit St-Charles and he claims that the standard deviation of this time is 2 days for the lawns in the village. To test his claim you observe a random sample of 16 dandelion flowers. The sample standard deviation of the transformation time is 42 hours. Does this sample contradict Gaétan's claim? Formulate and implement a statistical test. Be sure to include bounds for the p-value.

- (3) (4 marks) A study of the amount of calcium in drinking water in Saint-Augustin produced the following six readings in *ppm*

9.5 9.6 9.3 9.5 9.7 9.2

Assume that the population is normally distributed.

- a) Construct a 98% confidence interval for the population mean.
- b) Construct a 98% confidence interval for the population standard deviation.

- (4) (3.5 marks) The lifetime, in years, of the wild turkeys in Saint-Hermas is well modelled by a normal random variable with mean of 4 years with a standard deviation of 1.6 years.
- a) Determine the probability that the average lifetime for a random sample of 12 wild turkeys from Saint-Hermas is more than 4.5 years.
 - d) Determine the 10th and 80th percentiles of the lifetimes of the wild turkeys in Saint-Hermas.

- (5) (3 marks) Many beehives are situated close to the airport fence in Sainte-Monique. A sample of 256 honeycombs from beehives in this area found particulate matter pollution (tiny particles of ash and soot) in 32 of them. Construct a 95% confidence interval for the population proportion of honeycombs from Sainte-Monique polluted with particulate matter. Based on this confidence interval can you claim with 95% confidence that more than 10% of the honeycombs are polluted?

- (6) (3.5 marks) Rivière-du-Nord passes through the community of La Chapelle. Five specimens of river water upstream from the crossing under A15 produced an average benzene concentration of 3.32 mg/L with standard deviation of 1.17 mg/L . Seven specimens of river water downstream from A15 had an average benzene concentration of 6.83 mg/L with standard deviation of 1.72 mg/L . Assuming that the two populations are normal construct a 99% confidence interval for the difference of benzene concentration before and after the A15 crossing. Does this confidence interval imply that there is a effect of highway A15 on the river flowing under it in terms of benzene contamination at all? Explain briefly.

- (7) (3.5 marks) Christophe lives in Saint-Jérusalem-d'Argenteuil and commutes for work to Saint-Janvier. He conjectures that the average commute takes him 25 minutes. Christophe decides to test this belief. He collects a sample of 86 commutes and finds a sample average commuting time of 22.3 minutes with a sample standard deviation of 8.4 minutes. On Christophe's behalf, test $H_0 : \mu = 25$ versus $H_1 : \mu < 25$ at the $\alpha = 0.05$ level of significance. Report a p -value. Make sure to draw a conclusion in the context of the problem.

- (8) (3.5 marks) In Sainte-Scholastique for a sample of 20 days in the winter, the mass ratio of fine to coarse air particles averaged $\bar{x}_1 = 0.51$ with standard deviation of $s_1 = 0.09$, and for a sample of 13 days in the spring the mass ratio average $\bar{x}_2 = 0.62$ with standard deviation of $s_2 = 0.11$. Assume the populations are normally distributed and have equal variances.

Implement a test of the hypothesis $H_0 : \mu_1 = \mu_2$ versus $H_1 : \mu_1 < \mu_2$ at $\alpha = 0.05$ level of significance. Make sure to report a p -value and draw a conclusion in the context of the problem.

- (9) (3.5 marks) The village of Saint-Benoît has not one, but two Mom-and-Pop eateries: 'Chez M. patate' and 'La Belle et la Brute'. Katherine likes frequenting both and she has kept tabs on how much money she has spend at either eatery for the last seven months. Here are the amounts rounded to the nearest dollar:

Month	Nov	Dec	Jan	Feb	Mar	Apr	May
Chez M. patate	40	42	10	16	33	44	36
La Belle et la Brute	30	52	20	42	26	21	48

Based on these samples formulate and implement a statistical test to check if Katherine spends more money per month in one of the eateries than in the other. Report a p -value. Make sure to draw a conclusion in the context of the problem.

- (10) (3.5 marks) Saint-Canut is a village with a few lousy traffic lights. The times (in seconds) Amelie spends waiting to cross the worst traffic light when going to work have been sampled 46 times and generated the following sample average, $\bar{x} = 53$ with sample standard deviation of $s = 7.8$ seconds. Construct 95% and 99% confidence intervals for Amelie's mean waiting times at this traffic light.