

## STAT651: Homework 4

This HW reviews confidence intervals, margin of errors and JMP output.

- (1) Suppose you can draw from the following four populations and calculate the sample mean. Which sample mean gives the smallest margin of error, and explain why?
  - (A) The population standard deviation is 1 the sample size is 40.
  - (B) The population standard deviation is  $\sqrt{2}$  the sample size is 80.
  - (C) The population standard deviation is  $\sqrt{0.25}$  the sample size is 20.
  - (D) The population standard deviation is  $\sqrt{0.5}$  the sample size is 60.
- (2) Suppose you draw a sample containing 20 observations). For each sample, you construct a 90% CI for the mean.
  - (i) What happens to the MoE if you use 80 observations rather than 20 observations?
  - (ii) What happens to the MoE if you construct a 99% confidence interval rather than a 90% confidence interval?
- (3) Anthropologists are trying to classify what they believe are ancient handaxes (ancient knives) made by early hominid (ancient humans) found in the Olduvai Gorge, in East Africa.

From previous field work it is known that the standard deviation of handaxes from this age is about  $\sigma = 2$  inches.

Suppose we want to construct a 99% CI for the mean length of a handaxe from the Olduvai Gorge, and we want the 99% CI to have margin of error 0.025inches, how should we choose the sample size?

- (4) I would like to construct a confidence interval to locate the mean height for a population of mammals. I draw a random sample, and the 99% confidence interval for the mean height is  $[20, 52]$  (for this interval the margin or error = 16). I would like to construct an interval which has a margin of error =8. What can I plausibly do to obtain a margin of error =8?
  - (A) Increase the sample size by factor eight.
  - (B) Increase the sample size by factor four.
  - (C) Since the critical values for the 99% and 80% confidence intervals are 2.56 and 1.28 respectively, we can decrease the level of confidence from a 99% level to 80% level.
  - (D) Either do (B) or (C).
  - (E) Either do (A) or reduce the standard deviation of the population.
- (5) Explain in a few sentences why we use the t-distribution distribution instead of the normal distribution in the analysis of the population mean.

In the next question we analyse the calf data. Import the Calf weight and hormones data into JMP ([https://www.stat.tamu.edu/~suhasini/teaching651/cow\\_birth\\_weights.csv](https://www.stat.tamu.edu/~suhasini/teaching651/cow_birth_weights.csv)). You should see many columns. The first four are the so called explanatory variables, such as TRT, lgg etc.) these contain information about the treatments the calves were given. The next 16 or so columns are the weights of the 44 calves taken over a period of 8 weeks (weights are take twice a week).

- (6) A farmer wants to ensure that his truck is able to carry 10, 8 week old calves. To do this he analyses the above data (he was an Aggie graduate student and really enjoyed his 651 class!).
- (i) He starts by trying to estimate the mean weight of a calf. Based on the data give an estimate of mean weight of an 8 week old calf (remember this is the sample mean, use the distribution option in JMP to obtain this information)?
  - (ii) He wants to construct an interval where the mean weight is likely to lie. Based on the sample mean and standard error in your JMP output calculate a 98% CI for the mean weight of a calf.

To answer the following question you will need the critical t-values corresponding to the upper tail probability for the t-distribution with 43 degrees of freedom. They are given in the table below.

probability	0.15	0.10	0.05	0.025	0.01
$t^*$	1.049	1.30	1.68	2.01	2.41