Statistics 251: Lab 7 Exercise – Inference (Part 2): Confidence Intervals

Important reminders:

1. Keep track of time so that you will finish on time.
2. Recall that for a random variable $X \sim Unif(a, b)$, then $E(X) = (a + b)/2$ and $Var(X) = (b - a)^2/12$.
3. You can use the R commands in the pre-reading for the simulation below.
   Note: To generate a random sample of size *n* from a Uniform distribution, use
   `runif(n, a, b)`

Exercise:

The weight of rhinestones used at a jewelry store is uniformly distributed between 1 and 5 grams. You would like to estimate the true mean weight of these rhinestones. You decide to use a confidence interval, i.e. a range of values that is likely to include the true population parameter of interest, for your estimation.

1. Simulate a sample of size 20 from the above distribution. **(20 min)**
   a) Compute your 95% confidence interval for the mean, assuming variance is known.
   b) Compute your 95% confidence interval for the mean, assuming variance is unknown.
      [Estimate variance with sample variance, $s^2 = \frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{x})^2$]
   c) For each of the two previous problems, repeat the process 10,000 times, and count how many times your confidence interval contains the true mean.
      Does it match up with what you expect?

2. Simulate a sample of size 100 from the above distribution. **(20 min)**
   a) Compute your 95% confidence interval for the mean, assuming variance is known.
   b) Compute your 95% confidence interval for the mean, assuming variance is unknown.
      [Estimate variance with sample variance, $s^2 = \frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{x})^2$]
   c) For each of the two previous problems, repeat the process 10,000 times, and count how many times your confidence interval contains the true mean.
      Does it match up with what you expect?