

## STAT 515 hw 7

*CIs for mean with  $\sigma$  unknown, sample size calculations*

*Attach a sheet with the R plots and R code printed on it. You may write out your other answers by hand if you want. Just try to make it easy for me grade!!*

1. Open R and enter `data(Loblolly)` into the console. This imports the Loblolly data set into the workspace. Type `?Loblolly` into the console to read a description of the data set.

- On how many trees was data collected?
- How many times was the height of each tree recorded?
- At what ages was the height of each tree recorded?
- Compute the mean  $\bar{X}_n$  and the sample standard deviation  $s$  for the heights of Loblolly pines which are 3 years old. Hint: Enter the command

```
x <- Loblolly$height[Loblolly$age==3]
```

Then to compute the mean  $\bar{X}$ , you can simply type `mean(x)` and for the standard deviation, you can type `sd(x)`.

- Generate a Normal QQ plot of the heights of the Loblolly pines at age 3. Turn in this plot. Use `qqnorm(x)`.
- Based on the QQ plot, do you think that the heights follow a Normal distribution?
- Compute a 95% confidence interval for the mean height of three-year-old Loblolly pines.
- Interpret this interval.
- Give a 95% percent confidence interval for the mean height of twenty-year-old Loblolly pines.
- If you had constructed 99% confidence intervals for the Loblolly heights, would they have been wider or narrower than the 95% confidence intervals?
- You plan to estimate the mean height of 3-year-old Loblolly pines in a different region of North America, and you need to know how many trees to measure. Give a recommended sample size if you want
  - a 95% confidence interval no wider than 0.25 feet.
  - a 99% confidence interval with margin of error no greater than 0.10.

2. Make a 95% confidence interval for the variance  $\sigma^2$  of the heights of Loblolly trees which are three years old in the following steps:

- Compute  $S_n^2$ .
- Find the degrees of freedom of the relevant Chi-square distribution.
- Find  $\chi_{\nu, 1-\alpha/2}^2$  and  $\chi_{\nu, \alpha/2}^2$ , where  $\nu$  is your answer to part (b).
- Compute the confidence interval.

3. You wish to estimate the proportion of bees in a beehive that are drones within 0.02 with confidence level 95%. A sample of 307 bees from a previous hive contained 44 drones.

- How many bees should you sample?
- If you ignore the data from the previous hive, how many bees would you recommend sampling?