STAT371 DISCUSSION 6 October 13, 2002

1. Statistical estimation

   - The estimate of population meanμ is sample mean $\bar{y}$
   - The estimate of population standard deviation σ is sample standard deviation s.

2. The standard error of the mean is

$$SE_{\bar{y}} = \frac{s}{\sqrt{n}}$$

   which is a measure of the reliability or precision of $\bar{y}$ as an estimate of μ: the smaller the SE, the more precise the estimate.
   Consider: What is the distincton between standard error and standard deviation?

3. Confidence interval

   - The construction of confidence interval:
     If the sample size is n, sample mean is $\bar{y}$, and the standard error is $SE_{\bar{y}}$, then the $(1-\alpha)\%$ confidence interval for μ is constructed as follows:

$$\bar{y} \pm t_{\frac{\alpha}{2}} \frac{s}{\sqrt{n}}$$

     where the criticl value $t_{\frac{\alpha}{2}}$ is determined from Student's t distribution with $df = n-1$. For instance, if $\alpha = 10$, then the 90% confidence interval is $\bar{y} \pm t_{0.5} SE_{\bar{y}}$.
   - The interpretation of a confidence interval:
     Suppose the 95% confidence interval of μ is (a,b), which of the following statement is true?
     - Pr{a< μ <b}=95%
     - We are 95% confidence that the population mean μ is between a and b.
     - Pr{a< $\bar{y}$ <b}=95%

- We are 95% confidence that the sample mean $\bar{y}$ is between a and b.
- If we take 100 samples from the population and construct 100 95%confidence intervals. Then there will be 95 confidence intervals containing μ.
- Pr{the next sample will give us a confidence interval that contains μ}=0.95

4. Planning a study to estimate μ
   To get a desired standard error, the sample size should be:

$$\text{n} \geq (\frac{\text{Guessed SD}}{\text{Desired SE}})^2$$

Exercise:
Y follows a normal distribution with mean 20 and standand deviation 2. Take a sample from the population and get these data:
19.10672 20.49547 19.20281 16.81740 19.18170 19.44320 18.34311 19.51481 19.22503 25.53221 20.24905 18.80119 21.46908 sx

- get sample mean $\bar{Y}$ and sample standard deviation s
- the sample error
- Pr{19< $\bar{Y}$ <22}
- the 90% confidence interval for μ
- if we want the standard error to be less than 0.1, how large should the sample be?