Lecture 7 Accuracy of sample mean $\overline{X}$

Var ($\overline{X}$)= Var (X) divided by sample size n

What is X bar ? Called sample mean.

Standard error of the mean =SD($\overline{X}$)

= SD (X) divided by squared root of n

As sample size increases, the sample mean become more and more accurate in estimating the population mean

- Sample size needed to meet accuracy requirement

Sum of independent random variables from box A, mean μ, SD σ

- Sample size n =2
- Let X_1 , X_2 be the length of two independent phone calls (the phone call example : mean=2.5 minutes, SD=1 minute)
- Let $T=X_1+X_2$
- What is the variance of T? (=1+1) SD of T? (=sqrt 2)
- Sample size n=4
- $T= X_1 + X_2 + X_3+X_4$
- Var (T) = 1 + 1 + 1 + 1 =4 SD(T)= sqrt 4 =2

T= sum of n independent draws

$\bar{X}$= average of n independent draws

ar (T) = n σ^2 ;

D(T)= sqrt n times σ ;

$\sqrt{\quad}$ =Squared ro
sqrt

= T/n

D($\bar{X}$)= SD(T) / n = σ/ sqrt n

Difference of two sample means

- Assume independence
- Example: Does body position for epidural injections affect labor pain? Page 303, textbook, National Women's Hospital in Auckland : number of spinal segments blocked by the anesthetic
- Lying group : n1 =48, mean=8.8, SD=4.4
- Sitting group : n2=35, mean=7.1, SD=4.5
- Question : do we have enough evidence to tell which is better?
- SD of difference in mean = .9909, two-standard error interval : [-0.3, 3.7]. Ans. No.

Another example: from page 305 of book

- Individual 2-SE interval
- 2-SE interval for the difference
- Overlapping case
- Mean $\overline{X}$=14, SE =1.2
- Mean $\overline{Y}$=10, SE=1.1
- SE for difference of mean = sqrt $(1.2^2+1.1^2)$=1.627

- $SD(\overline{X}-\overline{Y}) = \text{sqrt}\ [\ SD(\overline{X})^2 + SD(\overline{Y})^2]$

$< SD(\overline{X}) + SD\ (\overline{Y})$