Confidence Intervals

Review

Standard error

– SE (of something), SD(of something)
Typically reserve SE for SD of a "statistic" computed from data

– "Magic formula" SE(avg of n items) = SD(1 item) / √n

– Less variation among averages than among individuals

– Estimating SE directly from collection of averages versus using n adjustment from SD of data

Using control charts

– Limits for tracking the SD of the process

– Importance of tracking both the mean and SD

Decision rules

– Decide between alternatives based on observed sample characteristic.

– Alternatives were simple, only two possible states of nature.

– Required careful analysis of opportunity costs, historical precedents.

Administrative Details

Reading

– Freedman et al. stories are great (polling, Ch 19 onward)

Assignment, Cases

– Need to do statistics in order to learn statistics.

Key Application for Today

Making statements about a process or population

– Parameter of population versus statistic from sample

– Revealing uncertainty/precision in sample statistics

– What is the process mean?

– What % will vote for candidate?

Definitions and Concepts

Confidence interval for the mean (p 95)

– Feasible range for the population mean, set of "plausible" values

– Found by "inversion" of probability statement.
Initial statement arises from: normality and knowing SE

– Chance for error and the confidence coefficient (95%)

– Effects of data variation and sample size

– Trade-off: length versus level of confidence

Role of assumptions

– Conclusions only as valid as the assumptions we use.

Features of all confidence intervals we'll use

– Standard error: the standard deviation of our "estimator"

– Use of empirical rule is helped by the central limit theorem.

– Intervals have the form

(estimate of population value) ± 2 SE(estimate)

Complementary idea... hypothesis testing

– Measure the number of standard errors away from some contemplated value (most often, the distance away from zero)

– CI gives "yes" or "no" answer for many values, whereas a "test" gives numerical measure for one.

Examples for Today

Control chart analysis of car trunk seam variation (p 80)

– Are the trunk seams of these cars meeting the design specs?

– Characteristics set by design, not from data being monitored.
If we let the data set the control limits, the output of the process stays inside the established range. When set to external standards, some means cross the control limits.

– Excessive variation rather than drift in the mean values.

– Control charts for SD as well as for average.

– Alternative types of control charts (85-88)

Interval estimates of the process mean (p 97)

– What can be said about the mean of this production process?
Might it be as small as 812 mils?

– Standard error suggests plausible range with high probability.

– "Inversion" gives a confidence interval for μ.

– Factors affecting length of confidence interval
- process variation
- sample size
- level of confidence (confidence coefficient)

– Interpretation of confidence coefficient

– Review of needed assumptions (p 102)

Purchases of consumer goods (p 104)

– What proportion of households will purchase a computer next year?

– Intent versus action

– Intervals for proportions

– Can get SE for proportion from JMP-IN output.

– "Dummy variable" coding of No/Yes data as zeros and ones.

– Average of 0/1 data *is* the sample proportion.