Multiple Comparison Test

I. Applications of Multiple Comparison Test

II. Assumptions:

II. Assumptions: same as ANOVA; normal populations, equal variances
- – appears to be robust to violations of assumptions
- – violation of equal variances more serious

III. Hypotheses:

H_0: $\mu_A = \mu_B$ H_A: $\mu_A \neq \mu_B$ A & B represent any possible pair of groups
if k groups, $k(k-1)/2$ different pairwise comparisons

IV. Tukey Test:

A. **Step 1:** arrange & number all sample means in order of increasing magnitude

B. **Step 2:** calculate pairwise differences, $\bar{X}_B - \bar{X}_A$

C. **Step 3:** calculate "q", analogous to "t" in t-test:

$$q = \frac{\bar{X}_B - \bar{X}_A}{SE} \qquad \text{SE} = \sqrt{\frac{\text{error MS}}{n}}$$

if sample sizes unequal, $$\text{SE} = \sqrt{\frac{s^2}{2}\left(\frac{1}{n_A} + \frac{1}{n_B}\right)}$$

D. **Step 4:** compare w/ critical value, $q_{\alpha,\nu,k}$ Zar, Table B5
α = P{make at least one type I error}, not P(type I error for a given comparison)
→ if $q_{calc} \geq q_{\alpha,\nu,k}$ then reject Ho

E. Order of comparisons
1) 1st, largest mean vs. smallest
2) 2nd, largest mean vs. next smallest
3) etc.

F. If cannot conclude difference betw/ 2 means, cannot conclude diff betw/ any means enclosed
⇒ do not test for differences in means enclosed by non-significant differences

G. Dealing w/ ambiguity in results

$\bar{X}_1$ $\bar{X}_2$ $\bar{X}_3$ $\bar{X}_4$ => samples 1&2 from different pop. than 2,3,4
– – – – – – ___________ impossible (2 from >1 pop)
conc: $\mu_1 \neq \mu_3 = \mu_4$, but cannot determine μ_2

H. Single-Factor ANOVA more powerful than multiple comparison test
(Type II errors more likely in multiple comparison test)