Confidence Intervals

For the $k = 2$ group comparison of means, a $100(1 - \alpha)\%$ confidence interval for $\mu_1 - \mu_2$ is

$$(\overline{x}_1 - \overline{x}_2) \pm t_{\alpha/2}(n_1 + n_2 - 2)s_P\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$$

where $t_\alpha(nu_1)$ is the $1 - \alpha$ probability point of the Student-t distribution with nu_1 degrees of freedom (under the assumptions of independence, Normality and equal group variances).

If we move to a family of c tests, to get simultaneous confidence intervals for the differences in means $\mu_i - \mu_j$ for all pairs of i and j, we should adjust α to α_F when computing the $100(1 - \alpha)\%$ confidence interval.

SPSS gives twelve different methods for correcting the confidence interval for use in different experimental situations. For example

- *planned* comparisons $\mu_1 = \mu_3$, $\mu_7 = \mu_{10}$ etc.
- *all* comparisons

Three methods are recommended:

- **Tukey's** Method
- **Bonferroni's** Method
- **Scheffé's** Method

Having selected a multiple comparison correction method, we compute simultaneous confidence intervals for each comparison of means, and identify

- which means are significantly different
- the ranking of differences $\mu_i - \mu_j$ in terms of magnitude.

1.4 Randomized Block Designs

A **randomized block design** used **matched** experimental units organized into sets known as **blocks** and assigns one member from the set to each treatment.

For k treatments

1. Compile b blocks of k experimental units, with each block comprising units that are similar.
2. Assign one unit from each block to each treatment at random.

Then there are a total of $n = bk$ measured responses.

We wish to **compare treatments** whilst acknowledging that there may be **differences between the blocks**.

That is, the observed variation is due to

TREATMENTS and BLOCKS and ERROR

rather than merely

TREATMENTS and ERROR

as in the CRD.

Example: SAT Scores.

- **Response** : Measured SAT Score
- **Factor** : Sex
- **Factor-levels** : $k = 2$ (Female/Male)
- **Blocks** : $b = 5$ (Previous GPA, within same school)

i.e. $k = 2, b = 5 \therefore n = 10$.

	Block	Female SAT	Male SAT
1	A: 2.75	540	530
2	B: 3.00	570	550
3	C: 3.25	590	580
4	D: 3.50	640	620
5	E: 3.75	690	690

Example: SAT Scores (continued).

This design recognizes that GPA score and school are likely to explain some variation in SAT Score, **but that neither is directly related to the “treatment” of interest (SEX - Female/Male).**

i.e. the **blocking** variable removes systematic variation in response that is not of primary interest.

We pick one Female and one Male in each school/GPA category, and pair them.

Example: Treatment for Hypertension.

- **Response** : Blood Pressure (mgHg)
- **Factor** : Drug Type
- **Factor-levels** : $k = 3$ (Drug 1, Drug 2, Drug 3)
- **Blocks** : $b = 4$ Age/Sex combinations
  - Female/Under 50
  - Male/Under 50
  - Female/Over 50
  - Male/Over 50

i.e. $k = 3, b = 4 \therefore n = 12$.