FORMULAE CRD & RBD

- $G.T. = \sum_{i=1}^{k}\sum_{j=1}^{n_i} y_{ij} = \sum_{i=1}^{k} T_i$
- $TSS = \sum_{i=1}^{k}\sum_{j=1}^{n_i} y_{ij}^2 - \frac{(G.T.)^2}{n}$
- $SST_r = \sum_{i=1}^{k} \frac{T_i^2}{n_i} - \frac{(G.T.)^2}{n}$
- $F_T \sim F_{(k-1,n-k)}$ *under* H_0

<u>Hartley's test:</u>

$$F_{\max} = \frac{s_{\max}^2}{s_{\min}^2} \sim F_{\max(k,[\bar{n}]-1)} \quad under\ H_0$$

$$R.E. = \frac{(b-1)MSB + b(k-1)MSE_{RB}}{(kb-1)MSE_{RB}}$$

↑ *relative efficiency*

- $h.s.d. = q_{\alpha(k,v)} \cdot \sqrt{\frac{MSE}{2}\left(\frac{1}{n_i} + \frac{1}{n_j}\right)}$, $v = error\ d.f.$

  or C.I.: $(\mu_i - \mu_j) \in \left((\bar{y}_i - \bar{y}_j) \pm q_\alpha(k, n-k)\sqrt{\frac{MSE}{2}\left(\frac{1}{n_i} + \frac{1}{n_j}\right)} \right)$

- <u>Kruskal-Wallis</u>:

  $H = \frac{12}{n(n+1)}\left[\sum_{i=1}^{k} \frac{T_{R_i}^2}{n_i}\right] - 3(n+1)$, *under* H_0 $H \sim \chi^2_{(k-1)}$

- <u>Dunn's Procedure</u>: Check : $\sum_{i=1}^{k} T_{R_i} = \frac{n(n+1)}{2}$

  $critical\ range = z_{\frac{\alpha}{k(k-1)}} \cdot \sqrt{\frac{n(n+1)}{12}\left(\frac{1}{n_i} + \frac{1}{n_j}\right)}$,

  or C.I.: $(Md_i - Md_j) \in \left((\bar{R}_i - \bar{R}_j) \pm z_{\frac{\alpha}{k(k-1)}}\sqrt{\frac{n(n+1)}{12}\left(\frac{1}{n_i} + \frac{1}{n_j}\right)} \right)$

- $TSS = \sum_{i=1}^{k}\sum_{j=1}^{b} y_{ij}^2 - \frac{(G.T.)^2}{bk}$ $\qquad F_T \sim F_{[k-1,(b-1)(k-1)]}$ *under* H_0
- $SST_r = \sum_{i=1}^{k} \frac{T_i^2}{b} - \frac{(G.T.)^2}{bk}$ $\qquad F_B \sim F_{[b-1,(b-1)(k-1)]}$ *under* H_0
- $SSB = \sum_{j=1}^{b} \frac{B_j^2}{k} - \frac{(G.T.)^2}{bk}$
- <u>Friedman Rank test</u>: $F_R = \frac{12}{bk(k+1)}\left[\sum_{i=1}^{k} T_{R_i}^2\right] - 3b(k+1)$

  and $F_R \sim \chi^2_{(k-1)}$ *under* H_0

- Nemenyi's Procedure: Check: $\sum_{i=1}^{k} T_{R_i} = \frac{bk(k+1)}{2}$

$critical\ range = q_{\alpha(k,\infty)} \cdot \sqrt{\frac{k(k+1)}{12b}}$

or C.I.: $\left(Md_i - Md_j\right) \in \left(\left(\bar{R}_i - \bar{R}_j\right) \pm q_\alpha(k,\infty)\sqrt{\frac{k(k+1)}{12b}}\right)$

2-Factorial Design

- *TSS = SSA + SSB + SS(AB) + SSE*
- $TSS = \sum_{i=1}^{a}\sum_{j=1}^{b}\sum_{k=1}^{r} y_{ijk}^2 - \frac{(\sum_{i=1}^{a}\sum_{j=1}^{b}\sum_{k=1}^{r} y_{ijk})^2}{rab}$, where $\sum_{i=1}^{a}\sum_{j=1}^{b}\sum_{k=1}^{r} y_{ijk} = G.T.$
- $SSA = \sum_{i=1}^{a} \frac{y_{i}^2..}{rb} - \frac{(\sum_{i=1}^{a}\sum_{j=1}^{b}\sum_{k=1}^{r} y_{ijk})^2}{rab}$, where $y_i.. = \sum_{j=1}^{b}\sum_{k=1}^{r} y_{ijk}$
- $SSB = \sum_{j=1}^{b} \frac{y._j^2.}{ra} - \frac{(\sum_{i=1}^{a}\sum_{j=1}^{b}\sum_{k=1}^{r} y_{ijk})^2}{rab}$, where $y._j. = \sum_{i=1}^{a}\sum_{k=1}^{r} y_{ijk}$
- $SSTr = \sum_{i=1}^{a}\sum_{j=1}^{b} \frac{y_{ij}^2.}{r} - \frac{(\sum_{i=1}^{a}\sum_{j=1}^{b}\sum_{k=1}^{r} y_{ijk})^2}{rab}$, where $y_{ij}. = \sum_{k=1}^{r} y_{ijk}$
- $SSTr = SSA + SSB + SS(AB) \Rightarrow SS(AB) = SSTr - SSA - SSB$

Tukey CI's:

- $\left(\bar{y}_{ij.} - \bar{y}_{lm.}\right) \pm q_\alpha\left(ab, ab(r-1)\right)\sqrt{\frac{MSE}{r}}$ or $h.s.d. = q_\alpha\left(ab, ab(r-1)\right)\sqrt{\frac{MSE}{r}}$
- $\left(\bar{y}_{i..} - \bar{y}_{l..}\right) \pm q_\alpha\left(a, ab(r-1)\right)\sqrt{\frac{MSE}{br}}$ or $h.s.d. = q_\alpha\left(a, ab(r-1)\right)\sqrt{\frac{MSE}{br}}$
- $\left(\bar{y}_{.j.} - \bar{y}_{.m.}\right) \pm q_\alpha\left(b, ab(r-1)\right)\sqrt{\frac{MSE}{ar}}$ or $h.s.d. = q_\alpha\left(b, ab(r-1)\right)\sqrt{\frac{MSE}{ar}}$