Formulas Exam III

$n = n_1 + n_2 + \cdots + n_m$

SSTO = $\sum_{i=1}^{m} \sum_{j=1}^{n_i} x_{ij}^2 \; - \frac{1}{n}\left(\sum_{i=1}^{m} \sum_{j=1}^{n_i} x_{ij}\right)^2$, where $n = n_1 + n_2 + \cdots + n_m$

SST = $\sum_{i=1}^{m} \frac{1}{n_i}\left(\sum_{j=1}^{n_i} x_{ij}\right)^2 - \frac{1}{n}\left(\sum_{i=1}^{m} \sum_{j=1}^{n_i} x_{ij}\right)^2$

SSE = SST0 – SST = $\sum_{i=1}^{m} \sum_{j=1}^{n_i} x_{ij}^2 - \sum_{i=1}^{m} \frac{1}{n_i}\left(\sum_{j=1}^{n_i} x_{ij}\right)^2$

Source of Variation	df	SS	MS	F
Tmt	*m-1*	SST	SST/(*m-1*)	MST/MSE
Error	*n-m*	SSE	SSE/(*n-m*)	
Total	*n-1*	SSTO		

If the null hypothesis $H_0\colon \mu_1 = \mu_2 = \cdots = \mu_m = \mu$ is true:

E[MSTO] = E[MST] = E[MSE] = σ^2

Where σ^2 is the common variance of the normal populations from where each of the m samples (samples from each treatment) comes from.

If the null hypothesis is **not** true:

E[MSE] = σ^2, but

E[MST] = $\sigma^2 + \frac{1}{m-1}\sum_{i=1}^{m} n_i(\mu_i - \bar{\mu})^2$, and

E[MSTO] = $\sigma^2 + \frac{1}{n-1}\sum_{i=1}^{m} n_i(\mu_i - \bar{\mu})^2$, where $\bar{\mu} = \frac{\mu_1 + \mu_2 + \cdots + \mu_m}{m}$