Exam 1

Problem 1:

- Randomized block design model

(1) Model for keyboard efficiency w/out learning effect:

$$y_{ij} = \mu + \alpha_j + \tau_i + \varepsilon_{ij}$$

$i = 1, 2$ (keyboard)

$j = 1, \ldots, 6$ (MS)

$\varepsilon_{ij} \sim N(0, \sigma^2)$

- Goal: Difference b.w. 2 keyboards (i.e. $\tau = \tau_2 - \tau_1$)

- Estimate τ: $\hat{\tau} = \bar{y}_{2.} - \bar{y}_{1.}$

$\rightarrow$ Show $E(\hat{\tau}) = \tau_2 - \tau_1 = \tau$

(2) Model for keyboard efficiency w/ learning effect:

$$y_{ij} = \eta + \alpha_j + \tau_i + \delta_{ij} \ell_j + \varepsilon_{ij}$$

where $\delta_{ij} = \begin{cases} 1 & \text{if keyboard } i \text{ is used for 2nd MS } j \\ 0 & \text{o.w.} \end{cases}$

and ℓ_j = learning effect for MS j

→ assume learning effect is constant: $\ell_1 = \dots = \ell_6 = \ell > 0$

— Now find $E(\hat{\tau})$ for the 3 sequences (2 given in slides and 3rd sequence is balanced + randomized)