SG32 HW 6

1. c) Model: $y_{ij} = \mu + \underbrace{\alpha_i}_{\text{Random effects}} + \varepsilon_{ij}$

$\beta = \mu$ $\quad X = \begin{pmatrix} 1 \\ 1 \\ \vdots \\ 1 \end{pmatrix}_{95\times 1}$ $\quad Z = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ 0 & 1 & 0 & 0 & 0 \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ 0 & 0 & 1 & 0 & 0 \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ 0 & 0 & 0 & 1 & 0 \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ 0 & 0 & 0 & 0 & 1 \\ \vdots & \vdots & \vdots & \vdots & \vdots \end{bmatrix}_{95\times 5}$ $\quad \gamma = \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \\ \alpha_4 \\ \alpha_5 \end{bmatrix}_{5\times 1}$ $\quad \varepsilon = \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \vdots \\ \varepsilon_{95} \end{bmatrix}_{95\times 1}$

2. b) $\beta = \begin{pmatrix} \beta_0 \\ \beta_{02} \\ \beta_{03} \\ \beta_{04} \end{pmatrix}_{4\times 1}$ $\quad X = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 \\ \vdots & \vdots & \vdots & \vdots \\ 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 \end{pmatrix}_{16\times 4}$

(levels of "Supplier"; "Supplier" 1 | U_2 U_3 U_4)

$Z = \begin{bmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ 1 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \end{bmatrix}_{16\times 8}$ (Operator | Day) $\quad \gamma = \begin{bmatrix} \alpha_{1,1} \\ \alpha_{2,1} \\ \alpha_{3,1} \\ \alpha_{4,1} \\ \alpha_{1,2} \\ \alpha_{2,2} \\ \alpha_{3,2} \\ \alpha_{4,2} \end{bmatrix}_{8\times 1}$

$\varepsilon = \begin{bmatrix} \varepsilon_{1,1} \\ \varepsilon_{2,1} \\ \vdots \\ \varepsilon_{16,1} \end{bmatrix}_{16\times 1}$