1) $L(\mu_i, \sigma ; y_i) = \prod_{i=1}^{n} \frac{1}{2\sigma} \exp\left(-\frac{|y_i - \mu_i|}{\sigma}\right)$

$= \left(\frac{1}{2\sigma}\right)^n \exp\left(-\frac{1}{\sigma}\sum_{i=1}^{n}|y_i - \mu_i|\right)$

$\ell(\mu_i, \sigma ; y_i) = n \log\left(\frac{1}{2\sigma}\right) - \frac{1}{\sigma}\sum_{i=1}^{n}|y_i - \mu_i|$

$\frac{\partial \ell}{\partial \mu} = -\frac{1}{\sigma}\sum_{i=1}^{n}|y_i - \mu_i| \cdot [\mathrm{sgn}(y_i - \mu_i)] = 0$

$\sum_{i=1}^{n}|y_i - \mu_i| = 0$

$\therefore$ β^{MLE} of the double exponential distribution can be obtained by minimizing $\sum_{i=1}^{n}|y_i - \mu_i|$

2) $E(Y) = X^T\beta$, $E[\varepsilon_t] = 0$

$\Sigma = E[(Y - X^T\beta)(Y - X^T\beta)^T]$

$= E(\varepsilon\varepsilon^T)$

$= \begin{bmatrix} e_1 \\ e_2 + \theta e_1 \\ \vdots \\ e_{T-1} + \theta e_{T-2} \\ e_T + \theta e_{T-1} \end{bmatrix} \begin{bmatrix} e_1 & e_2 + \theta e_1 & \cdots & e_{T-1} + \theta e_{T-2} & e_T + \theta e_{T-1} \end{bmatrix}$

$= \begin{bmatrix} \sigma^2 & \theta\sigma^2 & 0 & \cdots & 0 \\ \theta\sigma^2 & (\theta^2+1)\sigma^2 & \theta\sigma^2 & \cdots & 0 \\ 0 & \theta\sigma^2 & (\theta^2+1)\sigma^2 & \cdots & 0 \\ \vdots & 0 & \theta\sigma & \ddots & \vdots \\ \vdots & \vdots & 0 & \ddots & \vdots \\ \vdots & \vdots & \vdots & \ddots & \theta\sigma^2 \\ 0 & 0 & 0 & \cdots & (\theta^2+1)\sigma^2 \end{bmatrix}$

3) Spatial Weight Matrix $= \begin{bmatrix} 0 & 0.0162 & 0.0423 & 0.1069 \\ 0.0162 & 0 & 0.1069 & 0.0143 \\ 0.0423 & 0.1069 & 0 & 0.1069 \\ 0.1069 & 0.0143 & 0.1069 & 0 \end{bmatrix}$

- The spatial influences of obs 2, 3, and 4 on obs 1 are 0.0162, 0.0423, and 0.1069 correspondingly.
- The spatial influences of obs 1, 3, and 4 on obs 2 are 0.0162, 0.1069, and 0.0143 correspondingly.
- The spatial influences of obs 1, 2, and 4 on obs 3 are 0.0423, 0.1069, and 0.1069 correspondingly.
- The spatial influences of obs 1, 2, and 3 on obs 4 are 0.1069, 0.0143, and 0.1069 correspondingly.

4) 1) $f(x;\lambda) = \frac{e^{-\lambda}\lambda^x}{x!}$

$= \exp[y \log\lambda - \lambda - \log y!]$

$\therefore$ $a(\phi) = 1$, $b(\theta) = e^\lambda = e^\theta$, $c(y, \phi) = -\log y!$

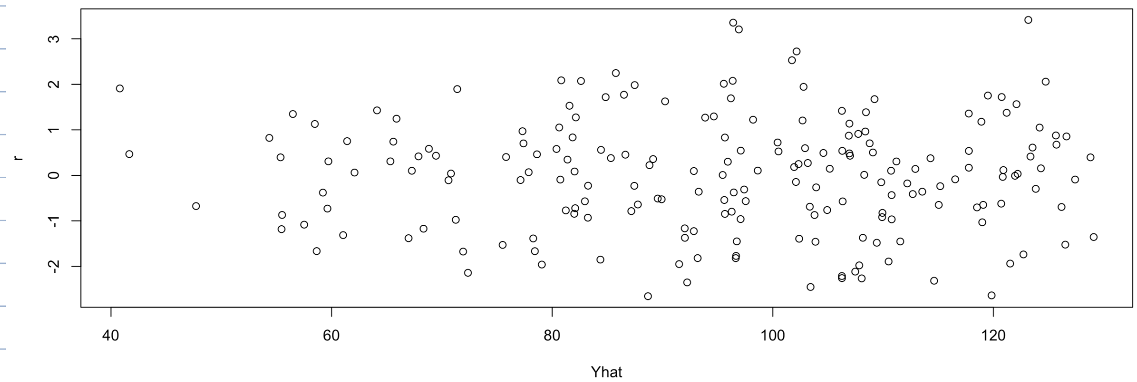
2) $b(\theta) = e^\lambda$

$\theta = \log\lambda$

5) 1) X_2 is an irrelevant input variable because both the p-value of X_2 in the full linear regression model and that of the regression model with only X_2 are not small enough. Also, the residual standard errors and the coefficients of determination do not vary much from having X_1 and X_3 to having all three predictors.

2) $Y = 31.622 + 4.874X_1 + 13.807X_3 - 0.963X_3^2 + \varepsilon$, $\varepsilon \sim N(0, \sigma^2)$

3)



4) With a fixed X_3, one unit increase in X_1 would add 4.874 of Y. With a fixed X_1, Y increases until $X_3 = 14$, but X_2 has a negative quadratic term, and the magnitude of decrease gets greater than that of increase starting $X_3 = 15$. 31.622 is the default value of Y assuming both predictor variables cannot have values under 0.