$$(1 - \beta - \beta)^2 + \lambda \beta^2$$

(a) RSS Ridge =
$$\sum_{i=1}^{M} (y_i - \beta - \beta x)^2 + \lambda \beta^2$$

$$\frac{dRSS}{dB} = 7 \sum_{i=1}^{n} (y_i - \beta - \beta x_i)(-1 - x_i) + \lambda \beta = 0$$

$$\frac{\partial \beta}{\partial x_{i}} = \sum_{i} (1 + \chi_{i}) \chi_{i} - (1 + \chi_{i}) \beta - (\chi_{i} + \chi_{i}^{2}) \beta$$

$$\Rightarrow \lambda \beta = \sum_{i} (1 + \chi_{i}) \chi_{i} - (1 + \chi_{i}) \beta - (\chi_{i} + \chi_{i}^{2}) \beta$$

$$\Rightarrow \lambda \beta = 2 \frac{(1+\lambda_i) \beta_i - (1+\lambda_i) \beta - (\lambda_i + \lambda_i) \beta}{(1+\lambda_i) \beta_i}$$

$$\Rightarrow \beta \left[\lambda_i + \sum_{i=1}^{n} (\lambda_i + \lambda_i^2 + 1 + \lambda_i) \right] = \sum_{i=1}^{n} \frac{(1+\lambda_i) \beta_i}{(1+\lambda_i) \beta_i}$$

$$\Rightarrow \beta \left[\lambda + \sum_{\lambda=1}^{n} (\chi_{\lambda} + \chi_{\lambda}^{2} + 1 + \chi_{\lambda}) \right] = \sum_{\lambda=1}^{n} (1 + \chi_{\lambda}) \psi_{\lambda}$$

$$\sum_{\lambda=1}^{n} (1 + \chi_{\lambda}) \psi_{\lambda}$$

$$E(\varepsilon) = 0, \quad Var(\varepsilon) = \delta^2$$

$$\mathcal{J} = \beta + \beta \chi + \varepsilon \longrightarrow \text{Var}(\mathcal{J}) = S^{2}$$

$$\text{Var}(\widehat{\beta}_{R}) = \text{Var}\left(\frac{\sum_{\hat{\lambda} \in I} (I + \chi_{\hat{\lambda}}) \mathcal{J}_{\hat{\lambda}}}{\lambda + \sum_{\hat{\lambda} \in I} (\chi_{\hat{\lambda}} + I)^{2}}\right)$$

$$Var\left(\beta_{R}\right) = Var\left(\frac{\sum_{i=1}^{N} (1+\chi_{i})y_{i}}{\lambda + \sum_{i=1}^{N} (\chi_{i}+1)^{2}}\right)$$

$$S^2$$

$$\int_{ar} (y) = S^2$$

$$\frac{1}{\alpha r} \left(\beta_{R} \right) = \sqrt{\alpha r} \left(\frac{\lambda_{R}}{\lambda + \sum_{k=1}^{N} (\chi_{k} + 1)^{2}} \right)$$

$$= \frac{\sum_{k=1}^{N} (1 + \chi_{k})^{2} \sqrt{\alpha r} (y_{k})}{\left[\lambda + \sum_{k=1}^{N} (1 + \chi_{k})^{2} \right]^{2}} = \frac{\sum_{k=1}^{N} (1 + \chi_{k})^{2}}{\left[\lambda + \sum_{k=1}^{N} (1 + \chi_{k})^{2} \right]^{2}} c^{2}$$

(C) To show
$$Var(\beta_R) \leq Var(\beta)$$

$$\frac{N}{\sum_{i=1}^{N} \left(1 + \chi_{i}\right)^{2}}$$

$$\frac{\sum_{\substack{k=1\\k=1}}^{n}(1+\chi_{k})^{2}}{\left[\lambda+\sum_{\substack{k=1\\k=1}}^{n}(1+\chi_{k})^{2}\right]^{2}} \otimes^{k} \leqslant \frac{\otimes^{k}}{\sum_{\substack{k=1\\k=1}}^{n}(1+\chi_{k})^{2}}$$

$$\longrightarrow \left(\sum_{\hat{A}=1}^{N} \left(1+\chi_{\hat{A}}\right)^{2}\right)^{2} \leq \left(\lambda + \sum_{\hat{A}=1}^{N} \left(1+\chi_{\hat{A}}\right)^{2}\right)^{2}$$

$$\frac{1}{\sqrt{1+1}} \left(\frac{1}{\sqrt{1+1}} \right)^2$$

Since
$$\lambda > 0$$
, and $\frac{\eta}{\tilde{\lambda}=1} (1+\chi_{\tilde{\lambda}})^2 > 0$

Thus, the equation
$$Var(\hat{\beta}_R) \leq Var(\hat{\beta})$$
 holds for all $\lambda > 0$