BST 140.752
Problem Set 5

1 Residuals

1. Go through the argument that the propensity score is a balancing score and fill in the details of the proof.
2. Give the number of continuous derivatives for the function $f(x) = \sum_{k=0}^{k} \beta_k x^k + \sum_{j=1}^{J} x(x - \xi_j)_+^k$ for known knot points.
3. Generate a sinusoid with noise around it. Use regression splines to fit the model.
4. Consider the model $Y_{ij} = \beta_0 + U_i + \epsilon_{ij}$ where $U_i \sim N(0, \sigma_u^2)$ and $\epsilon_{ij} \sim N(0, \sigma^2$. Derive $E[U_i|Y]$.
5. Consider $Y_i = \mu + \epsilon_i$ where $\epsilon_i \sim N(0, \sigma^2)$. Show that the REML estimate of σ^2 is unbiased.