

1. Explain why you would use spline regressions instead of a higher order polynomial that would be much easier to set up and use? [3 marks]
2. Draw a well labelled diagram of a neural network with two hidden layers and X_1, X_2, X_3, X_4 and X_5 as the input variables. [4 marks]
3. Define what is meant by a spline and illustrate using two examples. Show that splines are linear smoothers. [5 marks]
4. In Kernel regression estimation, one may choose a deterministic or stochastic design depending on the type of the problem at hand.
 - (a) Describe a deterministic design model and give its kernel estimate of the mean function. [3 marks]
 - (b) Describe a stochastic design model and give its kernel estimate of the mean function. [3 marks]
5. Given the data

X	20	30	15	25	28
Y	45.6	35.3	40.3	20.0	43.2

where X and Y are predictor and response variables, respectively. Using a rectangular Kernel function and 3 -nearest neighbour(K-NN) find the estimate of

- (a) Density function of X at point $x = 29$ and at $x = 34$ [3 marks]
 - (b) Regression function at point $x = 29$ and at $x = 34$ [3 marks]
6. Explain how to check the assumptions of a linear mixed model [3 marks]
7. Describe the main steps of the supervised training algorithm [3 marks]