Assignment 1 [Theory]

September 24, 2020

Last Date of submission in Moodle-KGP is 10/10/2020 11:59 Midnight

Submit your answer in one pdf document. Image or doc file will not be accepted.

Your name and roll number should be written in the first page.

1. Let $\mathbb{S} = \{x_1, x_2, ..., x_n\}$ be a finite set of vectors. Prove that $\mathbb{S}$ is linearly dependent if and only if $x_1 = 0$ or $x_{k+1} \in Span(\{x_1, x_2, ..., x_k\})$ for some $k < n$.

2. Consider a simple linear regression problem where the regression line is passing through origin. Perform an ANOVA for it.

3. Consider a multiple linear regression model $\mathbf{Y} = \mathbf{X}\boldsymbol{\beta} + \boldsymbol{\epsilon}$ where $\boldsymbol{\epsilon} \sim N(\mathbf{0}, \boldsymbol{\sigma^2 \Sigma})$. If Σ is non-singular and known and $rank(X) = r$ then is $\mathbf{Y^T \Sigma^{-1}(I - P_x)Y}/(n-r)$ an unbiased estimator of σ^2? Justify your answer.