# Introduction to Machine Learning
# Problem Set: Bias Variance Tradeoff and Model Order Selection

Summer 2021

1. (Based on a question by Prof. Sundeep Rangan) **Model class.**

   For each of the following pairs of true functions $t(x)$ and assumed model classes $f(x, w)$ determine whether the true function can be expressed by the assumed model class, i.e. is there a parameter vector $w_t$ such that $t(x) = f(x, w_t)$?

   If yes, also give the parameter vector $w_t$.

   (a) $t(x) = 1 + 2x$ and $f(x, w) = w_0 + w_1 x + w_2 x^2$

   (b) $t(x) = 1 + 2x + 5x^3$ and $f(x, w) = w_1 x + w_2 x^2 + w_3 x^3$

   (c) $t(x) = x/(2 + 3x)$, $f(x, w) = (w_0 + w_1 x)/(w_3 + w_4 x)$

   (d) $t(x) = (x_1 - x_2)^2$ and $f(x, w) = w_0 + w_1 x_1 + w_2 x_2 + w_3 x_1^2 + + w_4 x_2^2$

   (e) $t(x) = (1 - x)^3$ and $f(x, w) = w_0 + w_1 x + w_2 x^2 + w_3 x^3$

2. **Model order selection on neural data**.

   Please refer to the homework notebook posted on the class site.