Machine Learning from Data -IDC
HW5–Theory+ SVM

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June 10, 2021

1.

   (a) Let K, L be two kernels (operating on the same space)and let α, β be two positive scalars
   Prove that $\alpha K + \beta L$ is a kernel.

   (b) Provide (two different) examples of non-zero kernels K, L (operating on the same space), so that:

      i. $K - L$ is a kernel

      ii. $K - L$ is not a kernel

   Prove your answers.

2. Use Lagrange Multipliers to find the maximum and minimum values of the function subject to the given constraints:
   Function: $f(x, y, z,) = x^2 + y^2 + z^2$. Constraint: $g(x, y, z) = \frac{x^2}{\alpha^2} + \frac{y^2}{\beta^2} + \frac{z^2}{\beta^2} = 1$
   where $\alpha > \beta > 0$

3. Let $X = \mathbb{R}^2$. Let $C = H+\{h(a, b, c) = (x, y, z)s.t.|x| \leq a, |y| \leq b, |z| \leq cs.t.a, b, c \in \mathbb{R}_+\}$ the set of all origin centered boxes. Describe the polynomial sam-

ple complexity algorithm L that learns C using H. State the time complexity and sample complexity of your suggested algorithm. Prove all your steps.