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Statistical Machine Learning

Problem 1

1. The one on the left encourages sparse estimates, as it looks for points in $\hat{\beta}$ that have either β_1 or β_2 but not both, whereas the one on the right does not encourage sparse elements (as clearly evidenced by the fact that x_4 and x_5 now intersect with the cost function).
2. For the cost on the left, x_3 minimizes the cost, as it is the only point to intersect the constraint region. For cost on the right, two points x_3 and x_5 intersect the border of the constraint region, and one point x_4 lies within the constraint region. We are looking for a solution which minimizes the value on which we are constraining, so since x_4 lies within the region, its associated cost is less than the two points that lie on the border.

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Problem 2

1. Show that for any positive $a \in \mathbb{R}$, $k(x, x') = ak_1(x, x')$ is a kernel.
2. Show that $k(x, x') = k_1(x, x')k_2(x, x')$ is a kernel.
3. Show that for any positive $p \in \mathbb{Z}$, $k(x, x') = k_1(x, x')^p$ is a kernel.

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