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CS455/655-Mobile Sensor Networks: Homework 2. (100 points)

**Deadline: September 24:** Submit on Canvas/Webcampus

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The students first investigate the sigma norm concept to learn how it was developed and why it is differentiable everywhere rather than the traditional Euclidean norm through reading the following paper:

R. Olfati-Saber, "Flocking for multi-agent dynamic systems: algorithms and theory," in IEEE Transactions on Automatic Control, vol. 51, no. 3, pp. 401-420, March 2006.

doi: 10.1109/TAC.2005.864190

Use Matlab, Cpp, Python, etc. to:

1. **(80 points)** Write a programing function to compute a sigma norm defined in Equation (8) in Slide 14, Lecture 4.

Then enter following inputs to your written function to compute sigma norm of the following qi and qj  (you can set ϵ = 0.1):

* + qi = [1, 5] and qj = [7, 6]; input z = qi –qj
  + qi = [3, 8] and qj = [4, 5]: input z = qi –qj
  + qi = [6, 7] and qj = [5, 5]: input z = qi –qj

Answer: The sigma norm function was implemented as such

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1. **(20 points)** Compare values of sigma norm and Euclidean norm (you can put the results in a table to easily compare them). If you forget about the Euclidean norm, read Slide 7 in Lecture 4.

You can further test your sigma norm and compare it with Euclidean norm using different inputs of qi and qj than the ones defined in Question 1.

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The difference in value between the two normals grows exponentially when the points are farther away from each other, which makes sense because the difference is squared in the calculation of the sigma norm function.