# Curse of Dimensionality - Homework 1 Report

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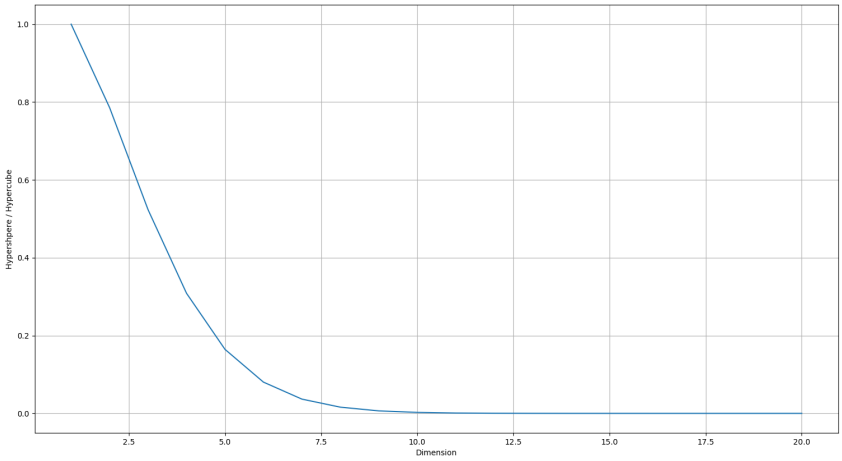
## Question 1

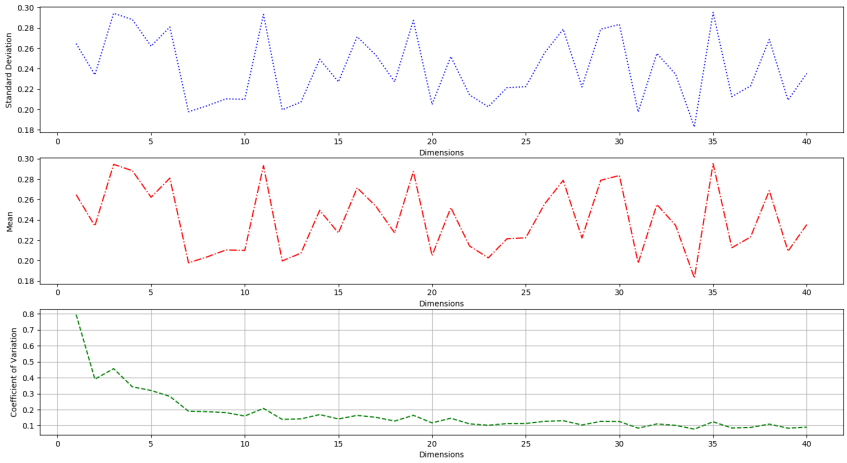
In the first question, it is asked that what is the ratio of the number of points in hypersphere and hypercube as dimension increases. In the code, 1 million random points generated in the hypercube for maximum of 20 dimensions.

As graph below indicates, ratio converges to zero. Also, it can be said that ratio becomes lower than 1% when dimension is 9.



# Question 2

In the second question, it is asked that what is the ratio of the standard deviation and mean, described as coefficient of variation, as dimension increases. For that, Euclidean distance between two random points in the hypercube is calculated. This process is repeated for 30 times for each dimension. Then average and standard deviation of the distances calculated. Using that, coefficient of variation is evaluated. According to the results, it can be said that the ratio converges to 0.1, which means standard deviation decreases. Decrease of standard deviation means feature points become less diverse.



# Question 3

In the last question, relation between dimension and angle between two random generated vectors in hypercube is asked. In the code, maximum of 100 dimension is used and for each dimension, 20 different experiment is repeated. As a result, it is clear that angle between two vectors converges to 90 degrees, which means they are becoming orthogonal. Orthogonal vectors means they are becoming independent, which verifies the curse of dimensionality.