This task will be considered as your Assignment 2 and no marks will be given without evaluation so don't share your code with anyone. Plagiarism will lead to students getting 0 in the whole assignments/quiz category.

You have worked on K-Means on the “Mall Customers” dataset. Use the same dataset for this task.”.

1. Find the optimum number of clusters using silhouette analysis
2. Find the optimum number of clusters using elbow method

Using the variables “Annual Income” and “Spending Score

3. Implement Hierarchical clustering (Agglomerative) **FROM SCRATCH**

4. Implement Hierarchical clustering (Agglomerative) using scipy library. Single, complete, average all three methods should be implemented and visualized using dendrograms and find the optimum number of clusters for each method)

5. Visualize and compare the results of both of your implementations.

Sample code and helping material:

1. https://github.com/OlaPietka/Agglomerative-Hierarchical-Clustering-from-scratch/blob/main/clustering_algorithm.py

2. https://www.w3resource.com/python-exercises/math/python-math-exercise-75.php

3. https://github.com/Darkprogrammerpb/DeepLearningProjects_when_I_was_a_noob/blob/master/Project40/agglomerative_hierarchial_clustering/Hierarchial%20Agglomerative%20clustering.ipynb

4. https://medium.com/@darkprogrammerpb/agglomerative-hierarchial-clustering-from-scratch-ec50e14c3826

5. https://www.kaggle.com/code/vipulgandhi/hierarchical-clustering-explanation

Finding optimum clusters using dendrograms

1. **https://www.datacamp.com/tutorial/introduction-hierarchical-clustering-python**

2. **https://www.analyticsvidhya.com/blog/2019/05/beginners-guide-hierarchical-clustering/**