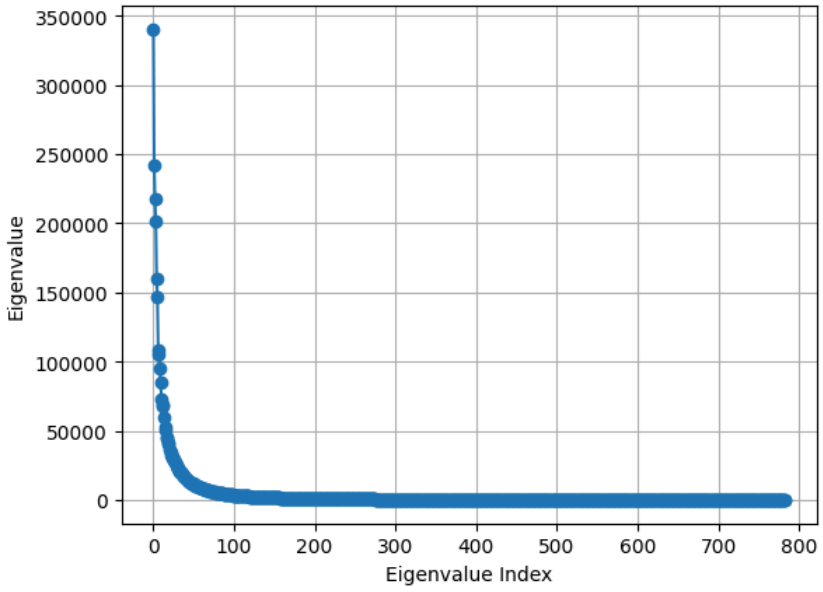
# Assignment 1

## Question 1

### Part (i)

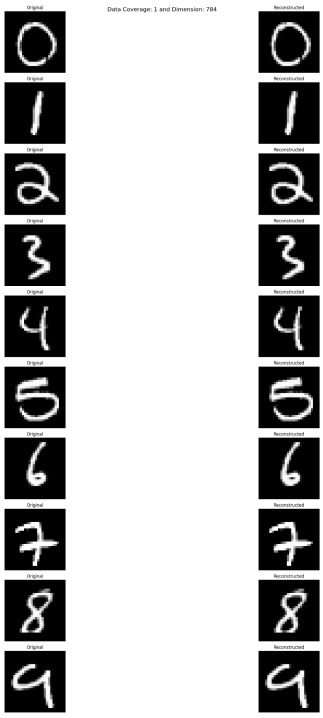
- Principal component of the 1st largest eigen value represents 0.10 fraction of the dataset
- Principal component of the  2th largest eigen value represents 0.07 fraction of the dataset
- Graph showing the drop in the variance covered is presented below

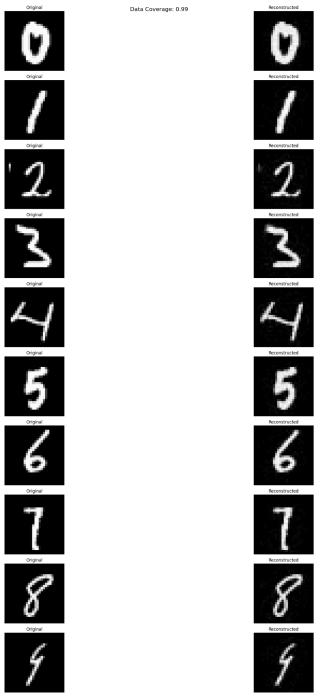


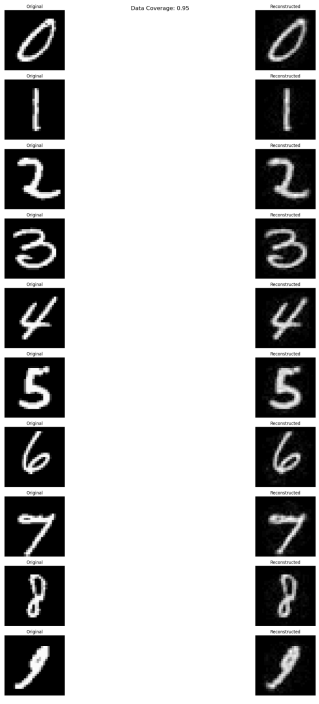

- Reconstructed Image is present below

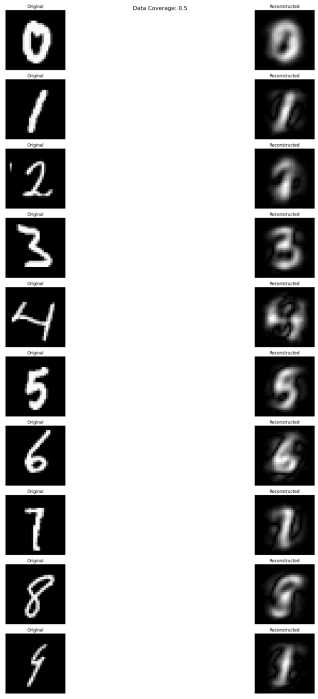
### Part (ii)

Depending on the task the PCA algorithm is being utilized for, we can determine the dimension according to required variance coverage. For 0.99 variance coverage the dimensions of the reduced data was 277, for 0.95 it was 132 and for 0.5 it was 10.


Original
Reconstructed
Data Coverage: 1 and Dimension: 784


Original
Reconstructed
Data Coverage: 0.99


Original
Reconstructed
Data Coverage: 0.95


Original
Reconstructed
Data Coverage: 0.5

### Part (iii)

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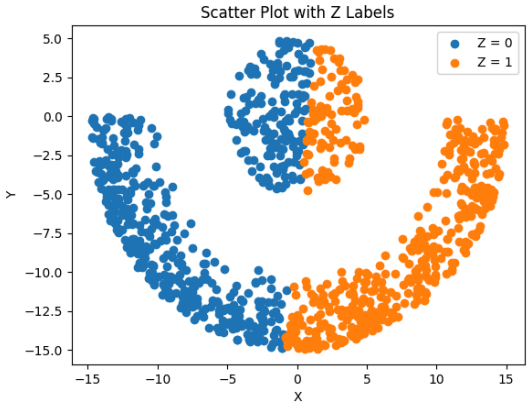
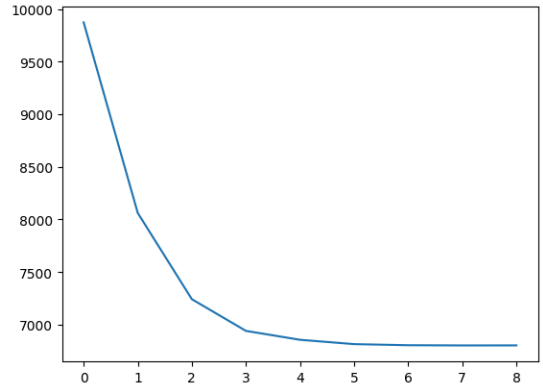
## Question 2

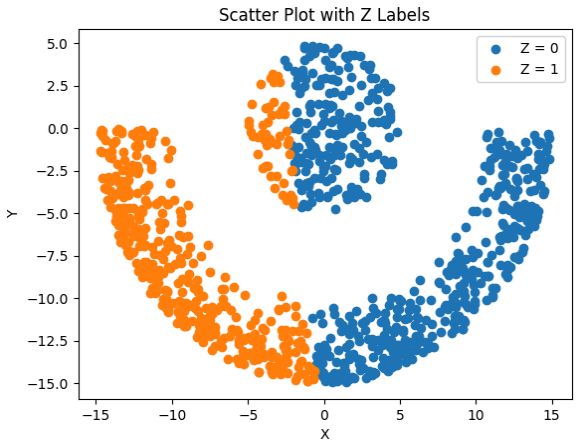
### Part (i)

Initialization 1

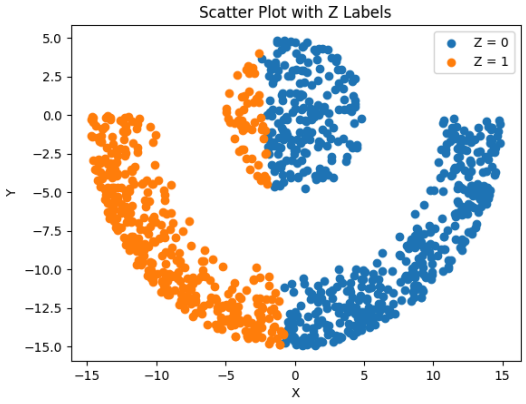


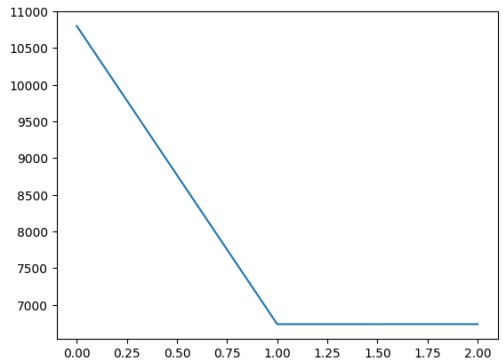



Initialization 2

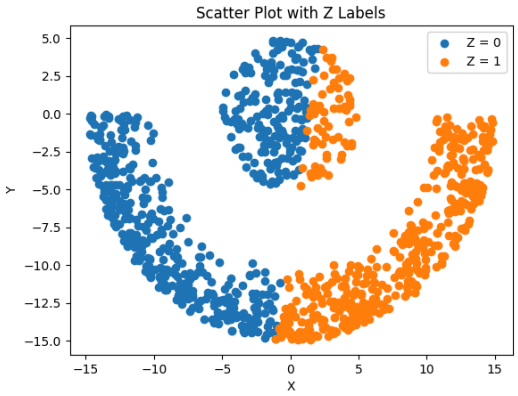


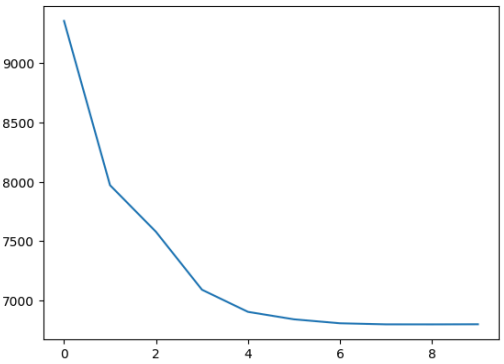
## Initialization 3:



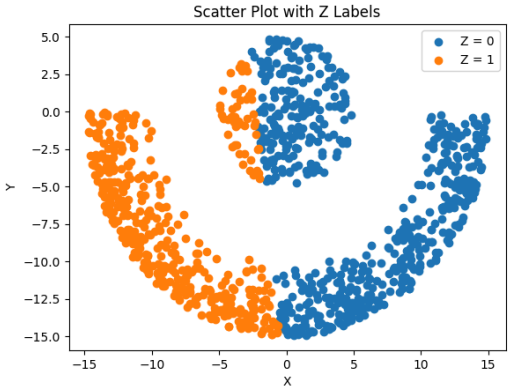



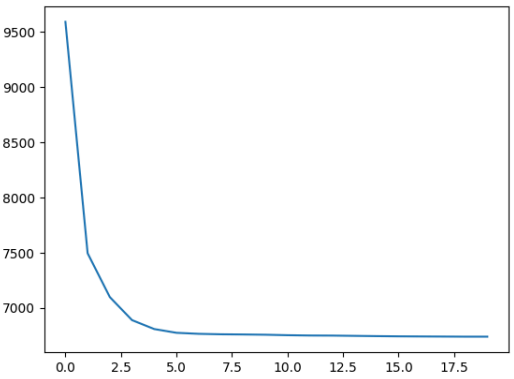
## Initialization 4:



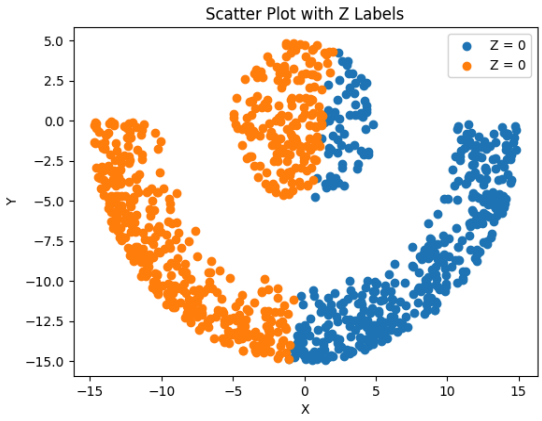
## Initialization 5:

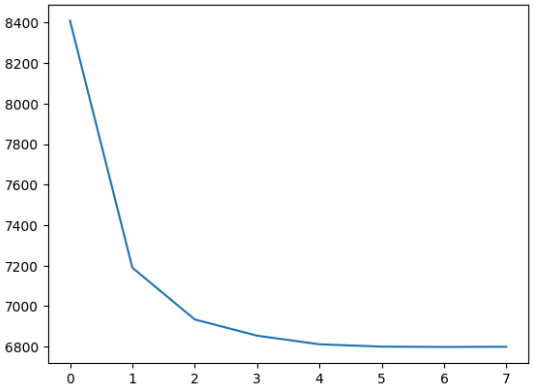


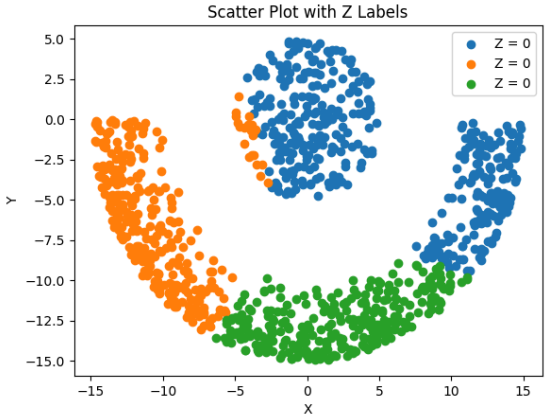
# Part (ii)

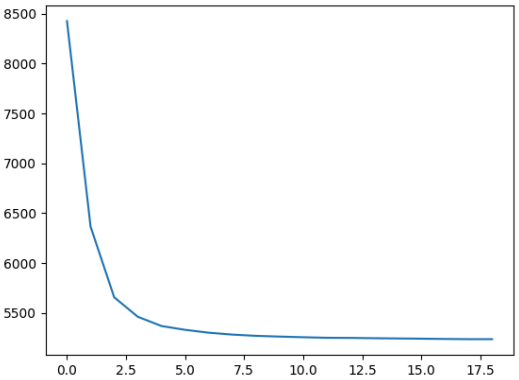
## K = 2



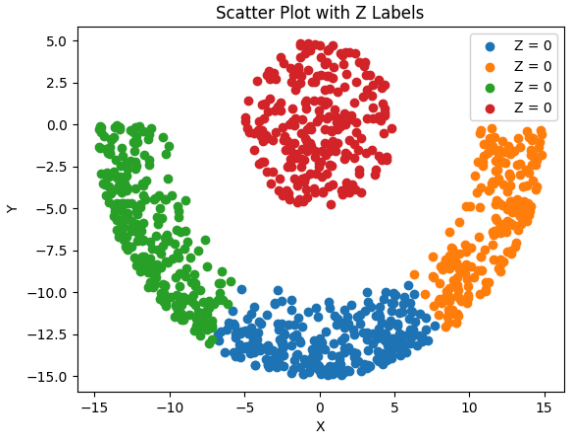



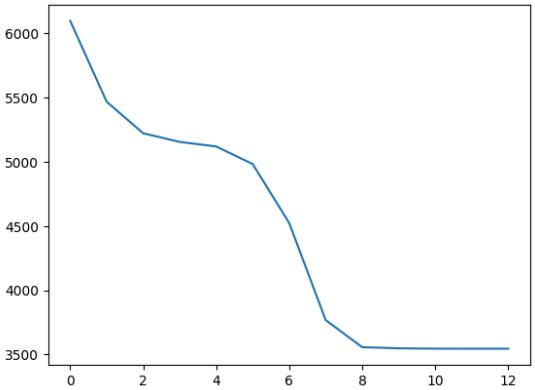
## K = 3



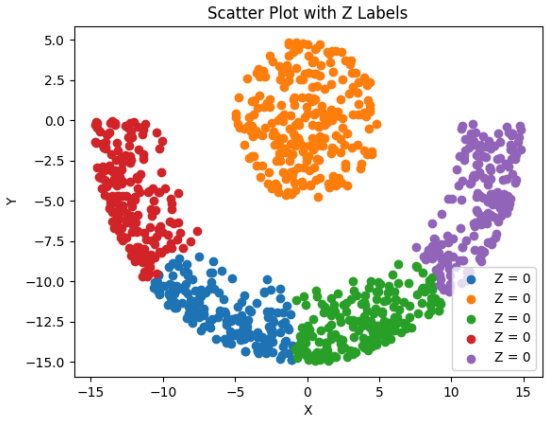



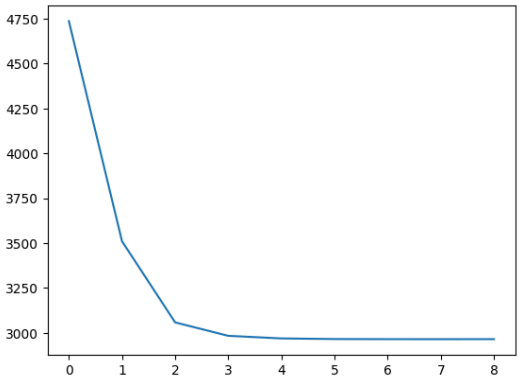
## K = 4



K = 5



## Part (iii)

## Part (iv)