Q3 part 2

In [1]:

```
import numpy as np
import idx2numpy
import random
from matplotlib import pyplot as plt
import cv2
import numpy as np
from sklearn.multiclass import OneVsRestClassifier
from sklearn.svm import SVC
from sklearn.metrics import precision_recall_fscore_support
from sklearn.metrics import accuracy_score
import pandas as pd
from sklearn.linear_model import LogisticRegression
```

In [2]:

```
train_images = idx2numpy.convert_from_file('train-images.idx3-ubyte')
train_labels = idx2numpy.convert_from_file('train-labels.idx1-ubyte')
test_images = idx2numpy.convert_from_file('t10k-images.idx3-ubyte')
test_labels = idx2numpy.convert_from_file('t10k-labels.idx1-ubyte')
train_new=[]
test_new=[]
for i in train_images:
    i=np.array(i)
    train_new.append(i.flatten())
for i in test_images:
    i=np.array(i)
    test_new.append(i.flatten())
train_images=train_new
test_images=test_new
```

In [3]:

```
clf = OneVsRestClassifier(LogisticRegression(random_state=0,max_iter=1000)).fit(train_ima
ges, train_labels)
# clf = OneVsRestClassifier(SVC()).fit(train_images, train_labels)
```

```
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lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
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  extra_warning_msg=_LOGISTIC_SOLVER_CONVERGENCE_MSG)
```

In [6]:

```
ac=accuracy_score(clf.predict(test_images),test_labels)
print("Accuracy=",ac)
fscore=precision_recall_fscore_support(clf.predict(test_images), test_labels, average='m
icro')
print("Precision=",fscore[0])
```

```
print("Recall=",fscore[1])
print("F1-Score=",fscore[2])
```

```
Accuracy= 0.9168
Precision= 0.9168
Recall= 0.9168
F1-Score= 0.9168
```