In [1]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.cluster import KMeans
from sklearn import metrics
from sklearn.pipeline import Pipeline
from sklearn.decomposition import PCA
import warnings
warnings.simplefilter('ignore')
```

In [2]:

```
initial_trian=pd.read_csv('Data science algorithms.csv')
```

In [3]:

```
X_train=initial_trian.iloc[:,1:].values
Y_train = initial_trian.iloc[:,0].values
X_train=np.mod((np.abs(-1*(X_train<49)))+1,2)
```

In [4]:

```
def plot_d(digit, label):
    plt.axis('off')
    plt.imshow(digit.reshape((28,28)), cmap=plt.cm.gray)
    plt.title(label)

def plot_ds(digits, title, labels):
    n=digits.shape[0]
    n_rows=n/25+1
    n_cols=25
    plt.figure(figsize=(n_cols * 1, n_rows * 1.5))
    plt.subplots_adjust(wspace=0, hspace=0)
    plt.suptitle(title)
    for i in range(n):
        plt.subplot(n_rows, n_cols, i + 1)
        plot_d(digits[i,:], "%d" % labels[i])

def plot_clusters(predict, y, stats):
    for i in range(10):
        indices = np.where(predict == i)
        title = "Most freq item %d, cluster size %d, majority %d " % (stats[i,2], stats[i,1], stats[i,0])
        plot_ds(X_train[indices][:25], title, y[indices])

def clusters_stats(predict, y):
    stats = np.zeros((10,3))
    for i in range(10):
        indices = np.where(predict == i)
        cluster = y[indices]
        stats[i,:] = clust_stats(cluster)
    return stats


def imshowing(A,n):
    plt.imshow(A[n,:].reshape((28,28)),cmap='gray')
    print(i)

def clust_stats(cluster):
    class_freq = np.zeros(10)
    for i in range(10):
        class_freq[i] = np.count_nonzero(cluster == i)
    most_freq = np.argmax(class_freq)
    n_majority = np.max(class_freq)
    n_all = np.sum(class_freq)
    return (n_majority, n_all, most_freq)

def clusters_purity(clusters_stats):
    majority_sum  = clusters_stats[:,0].sum()
    n = clusters_stats[:,1].sum()
    return majority_sum / n


n=100000
n_digits=10
X = X_train[0:n, :]
Y = Y_train[0:n]
inputs = X[:n,:]
```

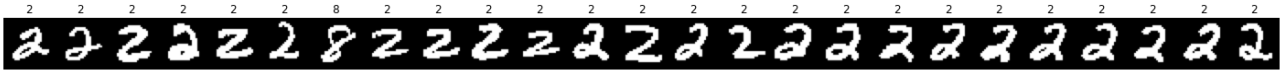
In [5]:

```
a=0
while(a<0.61):
    pca = PCA(n_components=n_digits)
    kmeans = KMeans(n_clusters=n_digits,n_init=1)
    predictor = Pipeline([('pca', pca), ('kmeans', kmeans)])

    predict = predictor.fit(inputs).predict(inputs)

    stats = clusters_stats(predict, Y)
    purity = clusters_purity(stats)
    a=purity
```

```
print("Plotting an extract of the 10 clusters, overall purity: %f" % purity)

plot_clusters(predict, Y, stats)
```

```
Plotting an extract of the 10 clusters, overall purity: 0.624050
```

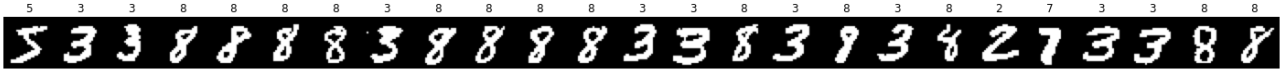
Most freq item 2, cluster size 4799, majority 4174



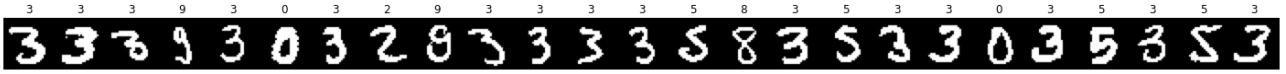
Most freq item 7, cluster size 4535, majority 3894

Most freq item 0, cluster size 3880, majority 1967

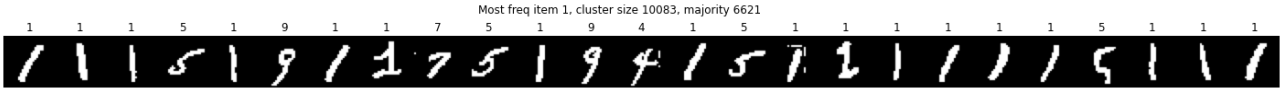
Most freq item 8, cluster size 6098, majority 3374



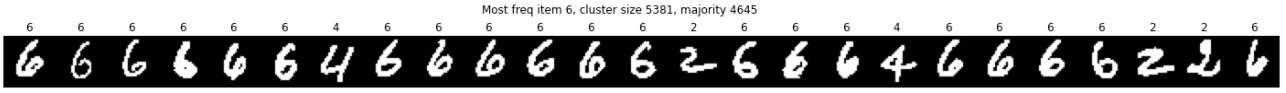
Most freq item 3, cluster size 7170, majority 3892



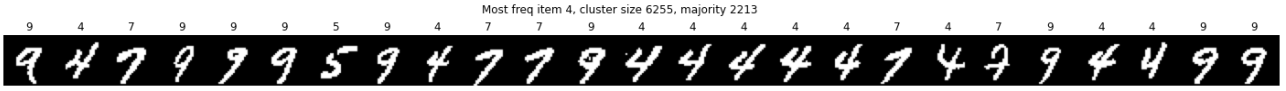
Most freq item 1, cluster size 10083, majority 6621



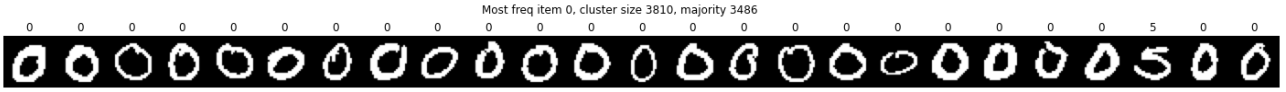
Most freq item 6, cluster size 5381, majority 4645



Most freq item 4, cluster size 6255, majority 2213



Most freq item 0, cluster size 3810, majority 3486



Most freq item 4, cluster size 7989, majority 3177