In [41]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

In [17]:

```
df0 = pd.read_csv("mnist_train.csv")
```

In [14]:

```
df0.head()
```

Out[14]:

	label	1x1	1x2	1x3	1x4	1x5	1x6	1x7	1x8	1x9	...	28x19	28x20	28x21	28x22	28x23	28x24	28x25	28x26	28x27	28x2
0	5	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
2	4	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
3	1	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
4	9	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0

5 rows × 785 columns

In [15]:

```
df0.columns
```

Out[15]:

```
Index(['label', '1x1', '1x2', '1x3', '1x4', '1x5', '1x6', '1x7', '1x8', '1x9',
       ...
       '28x19', '28x20', '28x21', '28x22', '28x23', '28x24', '28x25', '28x26',
       '28x27', '28x28'],
      dtype='object', length=785)
```

In [16]:

```
df0.shape
```

Out[16]:

```
(60000, 785)
```

In [25]:

```
#Saving the labels in an array such that t-SNE can be performed on the data
l = df0['label']
df = df0.drop('label',axis=1)
```

In [26]:

```
#creating a train set
data = df.head(42000)
```

In [36]:

```
labels = l.head(42000)
```

In [27]:

```
data.shape
```

Out[27]:

```
(42000, 784)
```

The train dataset has 42000 observations and 784 features

In [30]:

```
#Standardization of data

from sklearn.preprocessing import StandardScaler
stzd_data = StandardScaler().fit_transform(data)
```

In [31]:

```
stzd_data.shape
```

Out[31]:

```
(42000, 784)
```

In [34]:

```
#Applying t-SNE on the Standardized data
from sklearn.manifold import TSNE

model = TSNE(n_components=2, random_state=0)
```

In [35]:

```
tsne_data = model.fit_transform(stzd_data)
```

In [38]:

```
tsne_data=np.vstack((tsne_data.T, labels)).T
```

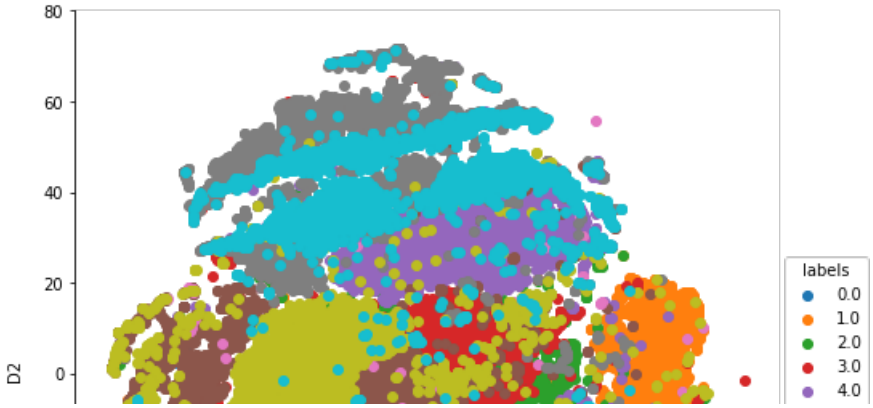
In [43]:

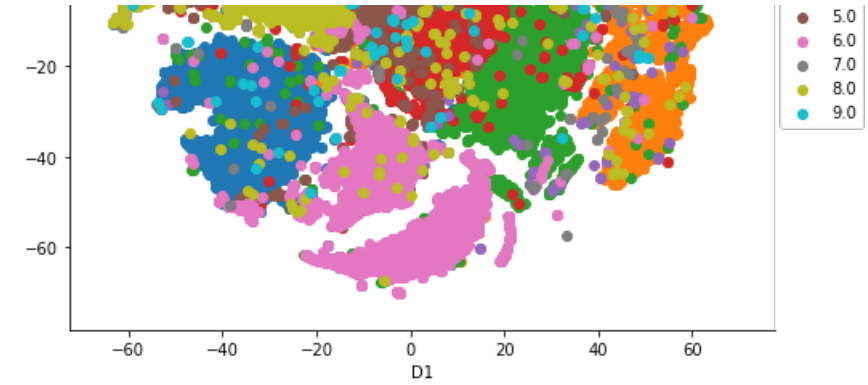
```
tsne_df = pd.DataFrame(data=tsne_data, columns=("D1","D2","labels"))
```

In [45]:

```
#Plotting

sns.FacetGrid(tsne_df,hue='labels',size=7) \
    .map(plt.scatter,'D1','D2')\
    .add_legend()
plt.show()
```





In [46]:

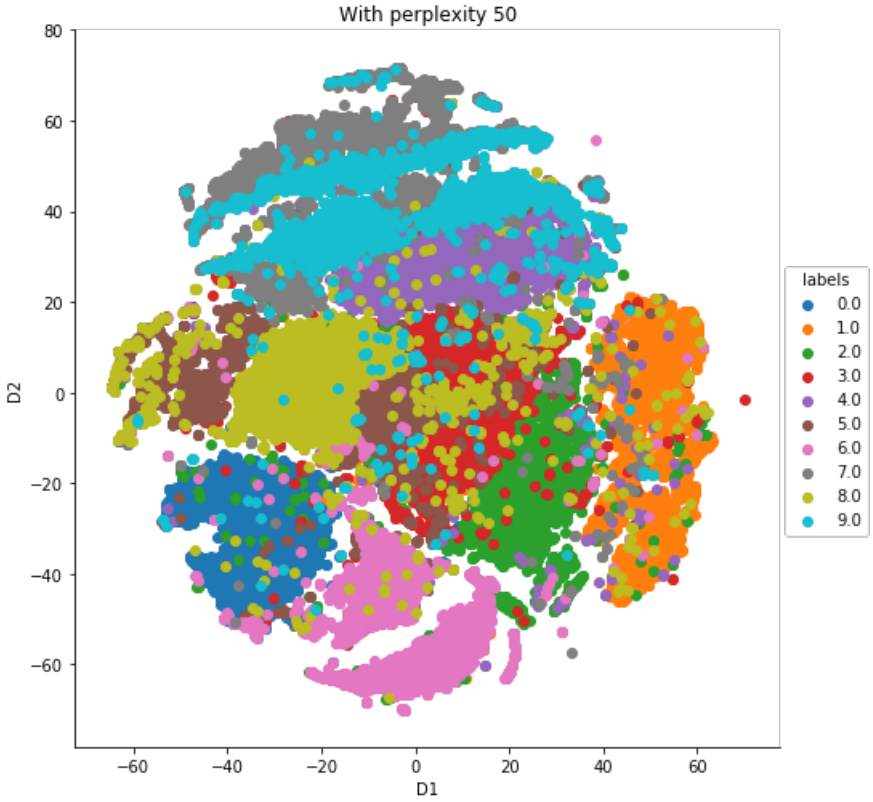
```
#Trying t-sne with different perplexity
model = TSNE(n_components=2, random_state=0,perplexity = 50)
tsne_data = model.fit_transform(stzd_data)
```

In [ ]:

```
tsne_data=np.vstack((tsne_data.T, labels)).T
tsne_df = pd.DataFrame(data=tsne_data, columns=("D1","D2","labels"))
```

In [47]:

```
sns.FacetGrid(tsne_df,hue='labels',size=7) \
    .map(plt.scatter,'D1','D2')\
    .add_legend()
plt.title("With perplexity 50")
plt.show()
```



In [ ]:

```
#Trying the same with more iterations
model = TSNE(n_components=2, random_state=0,perplexity = 50,n_iter=5000)
tsne_data = model.fit_transform(stzd_data)
```

In [49]:

```
tsne_data=np.vstack((tsne_data.T, labels)).T
tsne_df = pd.DataFrame(data=tsne_data, columns=("D1","D2","labels"))
```

In [50]:

```
sns.FacetGrid(tsne_df,hue='labels',size=7) \
    .map(plt.scatter,'D1','D2')\
    .add_legend()
plt.title("Perplexity 50 and iterations 5000 ")
plt.show()
```