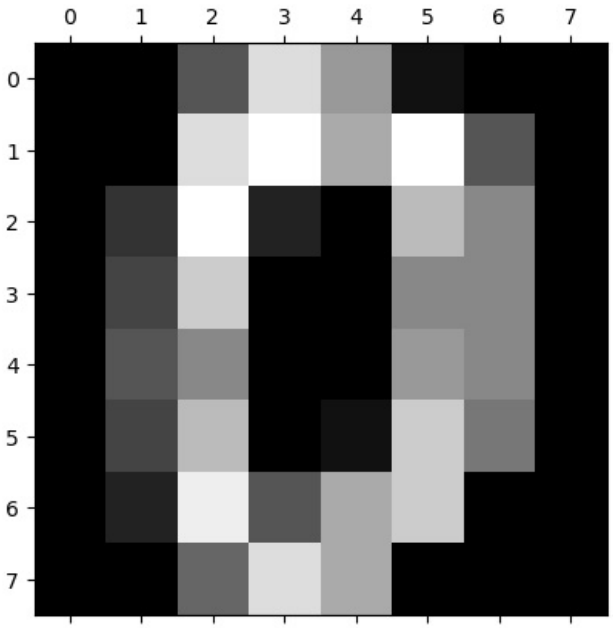
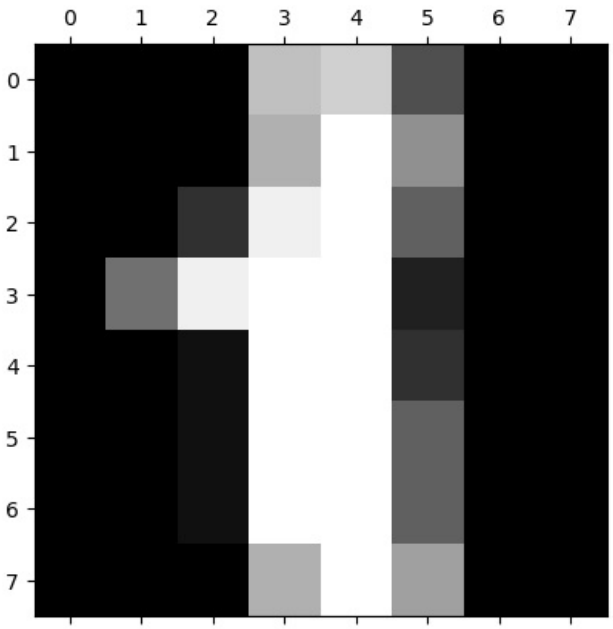
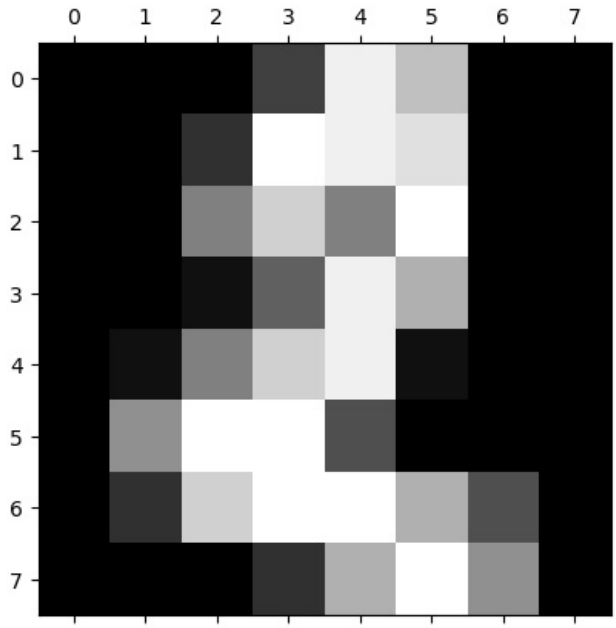
In [2]:
```
import pandas as pd
from sklearn.datasets import load_digits
digits=load_digits()
```

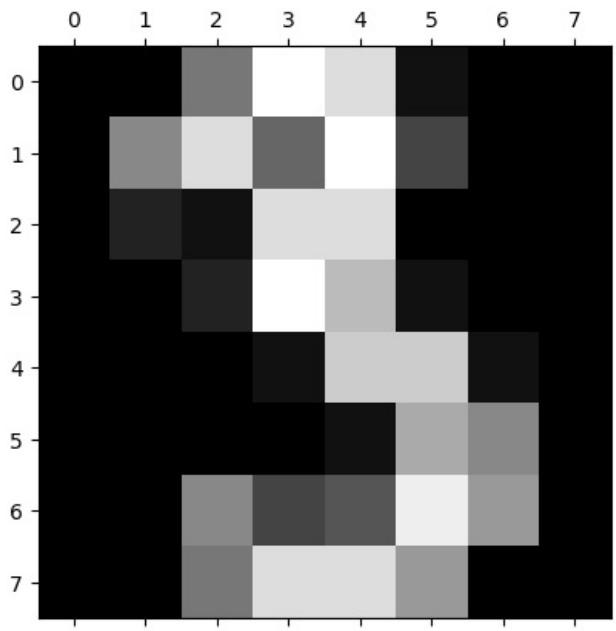
In [3]:
```
plt.gray()
for i in range(9):
    plt.matshow(digits.images[i])
```

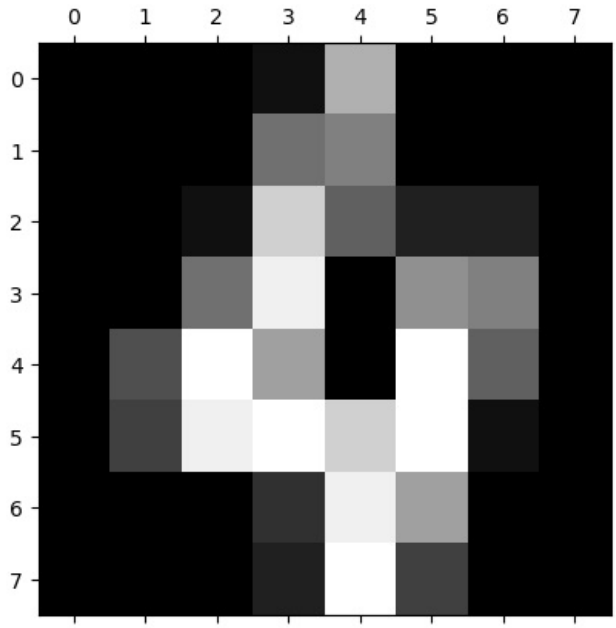
```
<Figure size 640x480 with 0 Axes>
```

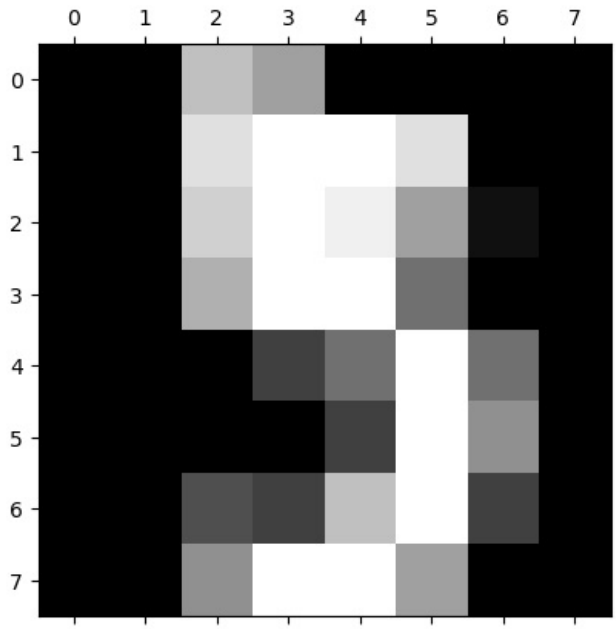


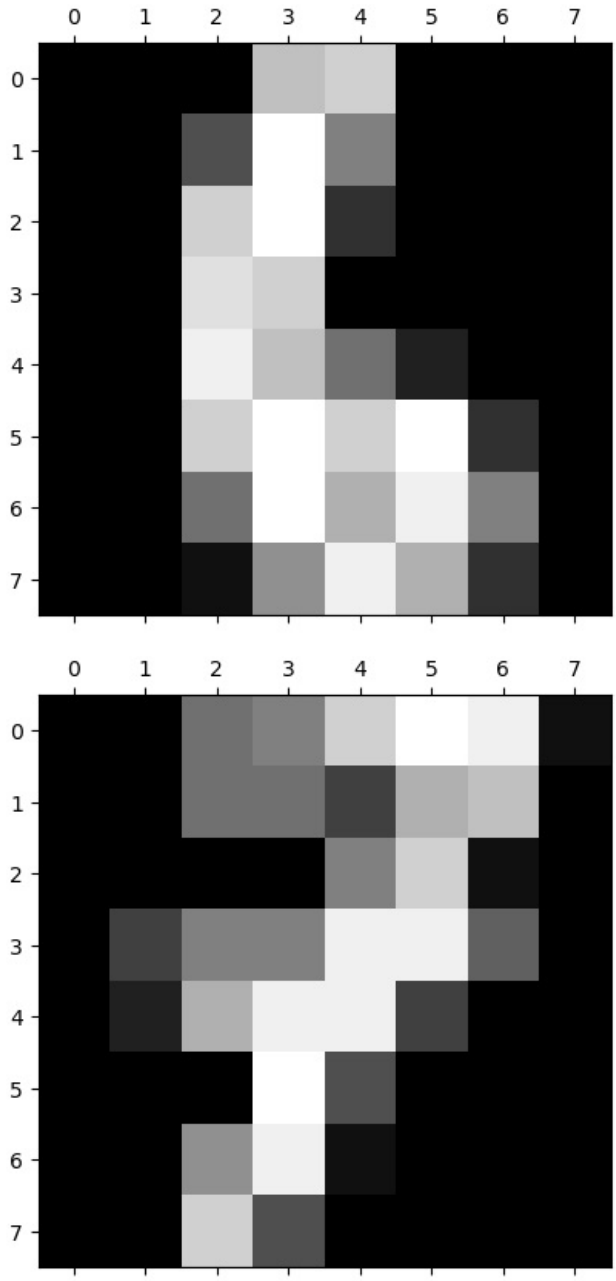


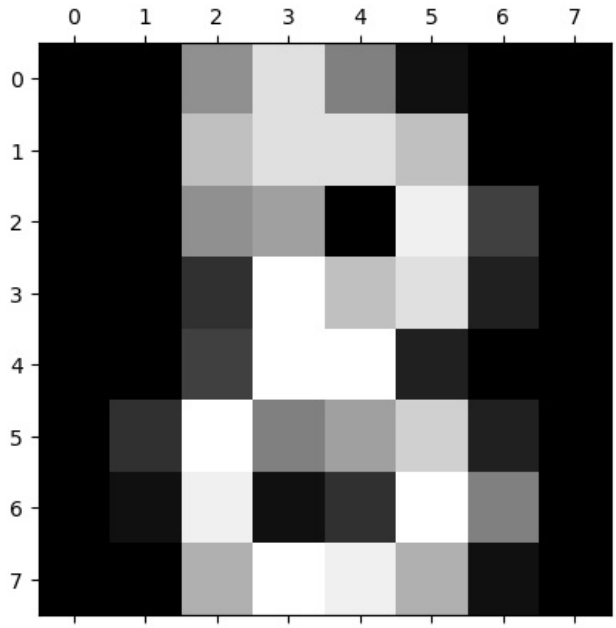

0 1 2 3 4 5 6 7
0
1
2
3
4
5
6
7


0 1 2 3 4 5 6 7
0
1
2
3
4
5
6
7


0 1 2 3 4 5 6 7
0
1
2
3
4
5
6
7


0 1 2 3 4 5 6 7
0
1
2
3
4
5
6
7


0 1 2 3 4 5 6 7
0
1
2
3
4
5
6
7



In [6]:
```
digits.feature_names
```

Out[6]:
```
['pixel_0_0',
 'pixel_0_1',
 'pixel_0_2',
 'pixel_0_3',
 'pixel_0_4',
 'pixel_0_5',
 'pixel_0_6',
 'pixel_0_7',
 'pixel_1_0',
 'pixel_1_1',
 'pixel_1_2',
 'pixel_1_3',
 'pixel_1_4',
 'pixel_1_5',
 'pixel_1_6',
 'pixel_1_7',
 'pixel_2_0',
 'pixel_2_1',
 'pixel_2_2',
 'pixel_2_3',
 'pixel_2_4',
 'pixel_2_5',
 'pixel_2_6',
 'pixel_2_7',
 'pixel_3_0',
 'pixel_3_1',
 'pixel_3_2',
 'pixel_3_3',
 'pixel_3_4',
 'pixel_3_5',
 'pixel_3_6',
 'pixel_3_7',
 'pixel_4_0',
 'pixel_4_1',
 'pixel_4_2',
 'pixel_4_3',
 'pixel_4_4',
 'pixel_4_5',
 'pixel_4_6',
 'pixel_4_7',
 'pixel_5_0',
 'pixel_5_1',
 'pixel_5_2',
 'pixel_5_3',
 'pixel_5_4',
 'pixel_5_5',
 'pixel_5_6',
 'pixel_5_7',
 'pixel_6_0',
 'pixel_6_1',
 'pixel_6_2',
 'pixel_6_3',
 'pixel_6_4',
 'pixel_6_5',
 'pixel_6_6',
 'pixel_6_7',
 'pixel_7_0',
 'pixel_7_1',
 'pixel_7_2',
 'pixel_7_3',
 'pixel_7_4',
 'pixel_7_5',
 'pixel_7_6',
 'pixel_7_7']
```

In [7]:
```
digits.target_names
```

Out[7]:
```
array([0, 1, 2, 3, 4, 5, 6, 7, 8, 9])
```

In [4]:
```
df = pd.DataFrame(digits.data,columns=digits.feature_names)
```

In [5]:
```
df
```

Out[5]:

	pixel_0_0	pixel_0_1	pixel_0_2	pixel_0_3	pixel_0_4	pixel_0_5	pixel_0_6	pixel_0_7	pixel_1_0	pixel_1_1	...	pixel_6_6	pix
0	0.0	0.0	5.0	13.0	9.0	1.0	0.0	0.0	0.0	0.0	...	0.0	
1	0.0	0.0	0.0	12.0	13.0	5.0	0.0	0.0	0.0	0.0	...	0.0	
2	0.0	0.0	0.0	4.0	15.0	12.0	0.0	0.0	0.0	0.0	...	5.0	
3	0.0	0.0	7.0	15.0	13.0	1.0	0.0	0.0	0.0	8.0	...	9.0	
4	0.0	0.0	0.0	1.0	11.0	0.0	0.0	0.0	0.0	0.0	...	0.0	
...	...	...	...	...	...	...	...	...	...	...	...	...	
1792	0.0	0.0	4.0	10.0	13.0	6.0	0.0	0.0	0.0	1.0	...	4.0	
1793	0.0	0.0	6.0	16.0	13.0	11.0	1.0	0.0	0.0	0.0	...	1.0	
1794	0.0	0.0	1.0	11.0	15.0	1.0	0.0	0.0	0.0	0.0	...	0.0	
1795	0.0	0.0	2.0	10.0	7.0	0.0	0.0	0.0	0.0	0.0	...	2.0	
1796	0.0	0.0	10.0	14.0	8.0	1.0	0.0	0.0	0.0	2.0	...	8.0	

1797 rows × 64 columns

In [8]:
```
df['target'] = digits.target
df.head()
```

Out[8]:

	pixel_0_0	pixel_0_1	pixel_0_2	pixel_0_3	pixel_0_4	pixel_0_5	pixel_0_6	pixel_0_7	pixel_1_0	pixel_1_1	...	pixel_6_7	pixel_
0	0.0	0.0	5.0	13.0	9.0	1.0	0.0	0.0	0.0	0.0	...	0.0	
1	0.0	0.0	0.0	12.0	13.0	5.0	0.0	0.0	0.0	0.0	...	0.0	
2	0.0	0.0	0.0	4.0	15.0	12.0	0.0	0.0	0.0	0.0	...	0.0	
3	0.0	0.0	7.0	15.0	13.0	1.0	0.0	0.0	0.0	8.0	...	0.0	
4	0.0	0.0	0.0	1.0	11.0	0.0	0.0	0.0	0.0	0.0	...	0.0	

5 rows × 65 columns

In [9]:
```
df['digit_name'] = df.target.apply(lambda x: digits.target_names[x])
```

In [10]:
```
df.head()
```

Out[10]:

	pixel_0_0	pixel_0_1	pixel_0_2	pixel_0_3	pixel_0_4	pixel_0_5	pixel_0_6	pixel_0_7	pixel_1_0	pixel_1_1	...	pixel_7_0	pixel_
0	0.0	0.0	5.0	13.0	9.0	1.0	0.0	0.0	0.0	0.0	...	0.0	
1	0.0	0.0	0.0	12.0	13.0	5.0	0.0	0.0	0.0	0.0	...	0.0	
2	0.0	0.0	0.0	4.0	15.0	12.0	0.0	0.0	0.0	0.0	...	0.0	
3	0.0	0.0	7.0	15.0	13.0	1.0	0.0	0.0	0.0	8.0	...	0.0	
4	0.0	0.0	0.0	1.0	11.0	0.0	0.0	0.0	0.0	0.0	...	0.0	

5 rows × 66 columns

In [11]:
```
from sklearn.model_selection import train_test_split
```

In [12]:
```
x = df.drop(['target','digit_name'],axis='columns')
```

In [13]:
```
x = df.drop(['target','digit_name'],axis='columns')
y = df.target
```

In [14]:
```
x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.2)
```

In [15]:
```
len(x_train)
```

Out[15]:
```
1437
```

In [16]:
```
len(x_test)
```

Out[16]:
```
360
```

In [21]:
```
from sklearn.neighbors import KNeighborsClassifier
knn = KNeighborsClassifier(n_neighbors=3)
```

In [23]:
```
knn.fit(x_train, y_train)
```

Out[23]:

```
KNeighborsClassifier(n_neighbors=3)
```

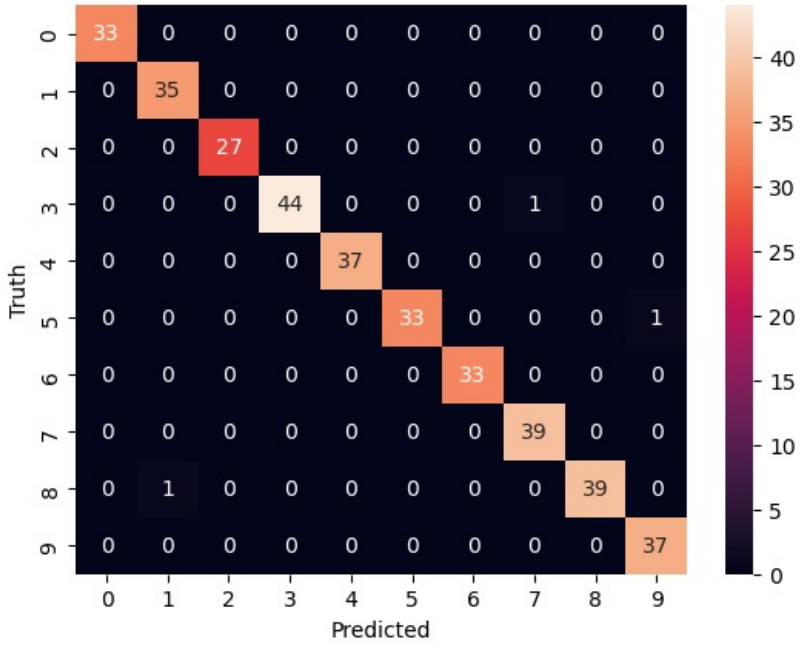
In [24]:
```
knn.score(x_test, y_test)
```

Out[24]:
```
0.9916666666666667
```

In [26]:
```
from sklearn.metrics import confusion_matrix
y_pred = knn.predict(x_test)
cm = confusion_matrix(y_test, y_pred)
cm
```

Out[26]:
```
array([[33,  0,  0,  0,  0,  0,  0,  0,  0,  0],
       [ 0, 35,  0,  0,  0,  0,  0,  0,  0,  0],
       [ 0,  0, 27,  0,  0,  0,  0,  0,  0,  0],
       [ 0,  0,  0, 44,  0,  0,  0,  1,  0,  0],
       [ 0,  0,  0,  0, 37,  0,  0,  0,  0,  0],
       [ 0,  0,  0,  0,  0, 33,  0,  0,  0,  1],
       [ 0,  0,  0,  0,  0,  0, 33,  0,  0,  0],
       [ 0,  0,  0,  0,  0,  0,  0, 39,  0,  0],
       [ 0,  1,  0,  0,  0,  0,  0,  0, 39,  0],
       [ 0,  0,  0,  0,  0,  0,  0,  0,  0, 37]], dtype=int64)
```

In [27]:
```
%matplotlib inline
import matplotlib.pyplot as plt
import seaborn as sn
sn.heatmap(cm, annot=True)
plt.xlabel('Predicted')
plt.ylabel('Truth')
plt.show()
```



In [ ]: