In [1]:
```
import numpy as np
import matplotlib.pyplot as plt
```

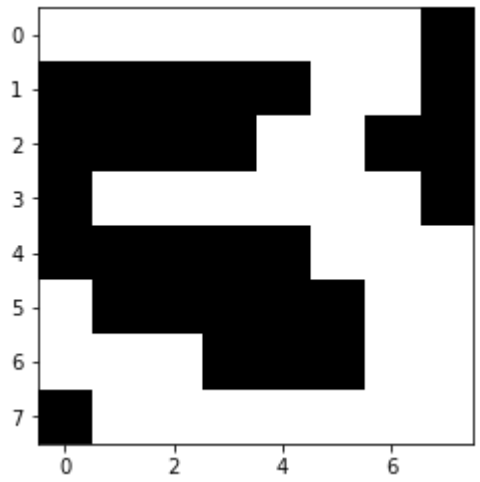
# Loading and Splitting Data

In [14]:
```
train_set = np.genfromtxt('set4_train.csv', delimiter=',')
ytr = train_set[:, -1]
Xtr = train_set[:, :-1]

test_set = np.genfromtxt('set4_test.csv', delimiter=',')
yte = test_set[:, -1]
Xte = test_set[:, :-1]

print(
    "train examples:\t{0}\ntest examples:\t{1}".format(len(ytr), len(yte))
)
```

```
train examples: 100
test examples:  400
```

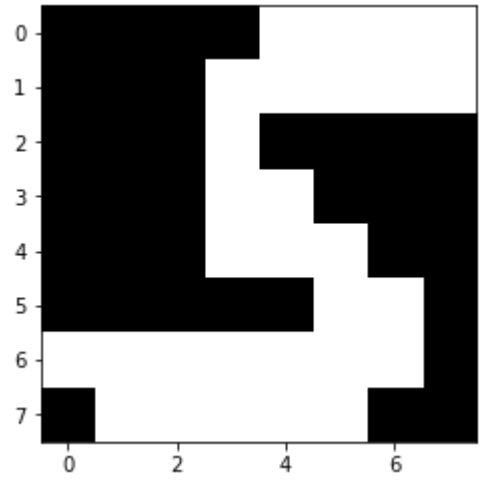
In [3]:
```
# positive example
display(plt.imshow(np.reshape(Xtr[5], (8,8)), cmap='gray'))
```

```
<matplotlib.image.AxesImage at 0x2b8a211dc18>
```



In [4]:
```
# negative example
display(plt.imshow(np.reshape(Xtr[-5], (8,8)), cmap='gray'))
```

```
<matplotlib.image.AxesImage at 0x2b8a5172208>
```




# Logistic Regressor Implementation

In [5]:
```
import keras
from keras.layers import Dense
from keras import Sequential
import keras.backend as K
```

```
c:\program files\python\lib\site-packages\h5py\__init__.py:36: FutureWarning:
Conversion of the second argument of issubdtype from `float` to `np.floating`
is deprecated. In future, it will be treated as `np.float64 == np.dtype(floa
t).type`.
  from ._conv import register_converters as _register_converters
Using TensorFlow backend.
```

In [6]:
```
model = Sequential()
model.add(Dense(1, input_dim=64, activation='tanh'))
model.compile(optimizer='SGD', loss='binary_crossentropy', metrics=['binary_ac
curacy'])
```

In [7]:
```
history = model.fit(Xtr, ytr, epochs=100)
```

```
Epoch 1/100
100/100 [==============================] - 0s 1ms/step - loss: -0.5719 - bina
ry_accuracy: 0.4600
Epoch 2/100
100/100 [==============================] - 0s 180us/step - loss: -0.7249 - bi
nary_accuracy: 0.4100
Epoch 3/100
100/100 [==============================] - 0s 201us/step - loss: -0.8701 - bi
nary_accuracy: 0.4400
Epoch 4/100
100/100 [==============================] - 0s 221us/step - loss: 5.4395 - bin
ary_accuracy: 0.5000
Epoch 5/100
100/100 [==============================] - 0s 291us/step - loss: 2.3112 - bin
ary_accuracy: 0.5000
Epoch 6/100
100/100 [==============================] - 0s 231us/step - loss: -1.5563 - bi
nary_accuracy: 0.4600
Epoch 7/100
100/100 [==============================] - 0s 221us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 8/100
100/100 [==============================] - 0s 251us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 9/100
100/100 [==============================] - 0s 261us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 10/100
100/100 [==============================] - 0s 201us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 11/100
100/100 [==============================] - 0s 251us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 12/100
100/100 [==============================] - 0s 241us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 13/100
100/100 [==============================] - 0s 170us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 14/100
100/100 [==============================] - 0s 181us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 15/100
100/100 [==============================] - 0s 281us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 16/100
100/100 [==============================] - 0s 281us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 17/100
100/100 [==============================] - 0s 191us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 18/100
100/100 [==============================] - 0s 241us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 19/100
100/100 [==============================] - 0s 220us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
```

```
Epoch 20/100
100/100 [==============================] - 0s 201us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 21/100
100/100 [==============================] - 0s 191us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 22/100
100/100 [==============================] - 0s 251us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 23/100
100/100 [==============================] - 0s 200us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 24/100
100/100 [==============================] - 0s 241us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 25/100
100/100 [==============================] - 0s 140us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 26/100
100/100 [==============================] - 0s 251us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 27/100
100/100 [==============================] - 0s 321us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 28/100
100/100 [==============================] - 0s 211us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 29/100
100/100 [==============================] - 0s 180us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 30/100
100/100 [==============================] - 0s 231us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 31/100
100/100 [==============================] - 0s 241us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 32/100
100/100 [==============================] - 0s 271us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 33/100
100/100 [==============================] - 0s 241us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 34/100
100/100 [==============================] - 0s 241us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 35/100
100/100 [==============================] - 0s 291us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 36/100
100/100 [==============================] - 0s 221us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 37/100
100/100 [==============================] - 0s 291us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 38/100
100/100 [==============================] - 0s 221us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
```

```
Epoch 39/100
100/100 [==============================] - 0s 190us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 40/100
100/100 [==============================] - 0s 241us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 41/100
100/100 [==============================] - 0s 170us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 42/100
100/100 [==============================] - 0s 241us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 43/100
100/100 [==============================] - 0s 170us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 44/100
100/100 [==============================] - 0s 281us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 45/100
100/100 [==============================] - 0s 211us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 46/100
100/100 [==============================] - 0s 221us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 47/100
100/100 [==============================] - 0s 221us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 48/100
100/100 [==============================] - 0s 190us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 49/100
100/100 [==============================] - 0s 211us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 50/100
100/100 [==============================] - 0s 231us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 51/100
100/100 [==============================] - 0s 221us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 52/100
100/100 [==============================] - 0s 251us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 53/100
100/100 [==============================] - 0s 180us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 54/100
100/100 [==============================] - 0s 271us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 55/100
100/100 [==============================] - 0s 271us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 56/100
100/100 [==============================] - 0s 171us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 57/100
100/100 [==============================] - 0s 170us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
```

```
Epoch 58/100
100/100 [==============================] - 0s 150us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 59/100
100/100 [==============================] - 0s 160us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 60/100
100/100 [==============================] - 0s 211us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 61/100
100/100 [==============================] - 0s 241us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 62/100
100/100 [==============================] - 0s 180us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 63/100
100/100 [==============================] - 0s 140us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 64/100
100/100 [==============================] - 0s 170us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 65/100
100/100 [==============================] - 0s 150us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 66/100
100/100 [==============================] - 0s 160us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 67/100
100/100 [==============================] - 0s 140us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 68/100
100/100 [==============================] - 0s 160us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 69/100
100/100 [==============================] - 0s 160us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 70/100
100/100 [==============================] - 0s 191us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 71/100
100/100 [==============================] - 0s 191us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 72/100
100/100 [==============================] - 0s 161us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 73/100
100/100 [==============================] - 0s 201us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 74/100
100/100 [==============================] - 0s 201us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 75/100
100/100 [==============================] - 0s 191us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 76/100
100/100 [==============================] - 0s 180us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
```

```
Epoch 77/100
100/100 [==============================] - 0s 201us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 78/100
100/100 [==============================] - 0s 201us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 79/100
100/100 [==============================] - 0s 160us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 80/100
100/100 [==============================] - 0s 180us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 81/100
100/100 [==============================] - 0s 160us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 82/100
100/100 [==============================] - 0s 170us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 83/100
100/100 [==============================] - 0s 160us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 84/100
100/100 [==============================] - 0s 190us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 85/100
100/100 [==============================] - 0s 170us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 86/100
100/100 [==============================] - 0s 170us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 87/100
100/100 [==============================] - ETA: 0s - loss: -1.0074 - binary_a
ccuracy: 0.53 - 0s 180us/step - loss: 0.0000e+00 - binary_accuracy: 0.5000
Epoch 88/100
100/100 [==============================] - 0s 150us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 89/100
100/100 [==============================] - 0s 170us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 90/100
100/100 [==============================] - 0s 120us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 91/100
100/100 [==============================] - 0s 180us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 92/100
100/100 [==============================] - 0s 180us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 93/100
100/100 [==============================] - 0s 180us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 94/100
100/100 [==============================] - 0s 191us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 95/100
100/100 [==============================] - 0s 170us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
```

```
Epoch 96/100
100/100 [==============================] - 0s 170us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 97/100
100/100 [==============================] - 0s 170us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 98/100
100/100 [==============================] - 0s 170us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 99/100
100/100 [==============================] - 0s 150us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
Epoch 100/100
100/100 [==============================] - 0s 160us/step - loss: 0.0000e+00 -
binary_accuracy: 0.5000
```

In [11]:
```
model.evaluate(Xte, yte)
```

```
400/400 [==============================] - 0s 98us/step
```

Out[11]: [0.0, 0.5]