In [ ]:

```
There are three basic from of images
1) Binary
2) Gray Scale
3) Colour
```

In [ ]:

```
1) Binary: Image is represented by 255(White) and 0(Black), for example:
```

In [1]:

```python
import cv2
im_a = cv2.imread('E:\\Learning\\Computer_Vision\\Digit Recognition\\A.jpg', cv2.IMREAD
_GRAYSCALE)
(thresh, im_bw) = cv2.threshold(im_a, 128, 255, cv2.THRESH_BINARY | cv2.THRESH_OTSU)
thresh = 127
im_bw = cv2.threshold(im_a, thresh, 255, cv2.THRESH_BINARY)[1]
cv2.imwrite('E:\\Learning\\Computer_Vision\\opencv\\sources\\samples\\data\\A.jpg', im_
bw)
```
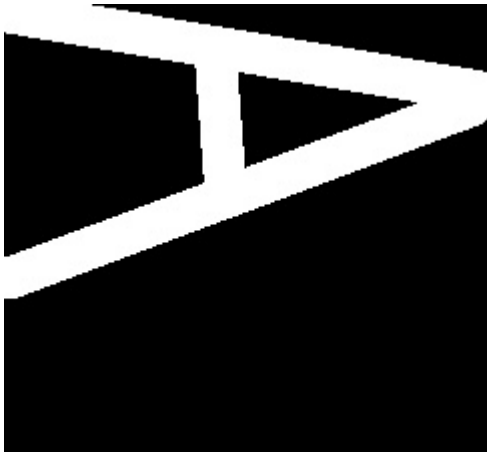
Out[1]:

True

In [2]:

```python
from IPython.display import Image
Image(filename='E:\\Learning\\Computer_Vision\\opencv\\sources\\samples\\data\\A.jpg')
```

Out[2]:

In [3]:

```python
img = cv2.imread('E:\\Learning\\Computer_Vision\\opencv\\sources\\samples\\data\\A.jpg'
,0)
img
```

Out[3]:

```
array([[255, 255, 255, ...,   0,   0,   0],
       [255, 255, 255, ...,   0,   0,   0],
       [255, 255, 255, ...,   0,   0,   0],
       ...,
       [  0,   0,   0, ...,   0,   0,   0],
       [  0,   0,   0, ...,   0,   0,   0],
       [  0,   0,   0, ...,   0,   0,   0]], dtype=uint8)
```

In [4]:

```python
#Here the resolution of image is:
img.shape
```

Out[4]:

```
(225, 242)
```

In [5]:

```python
type(img[0][0])
```

Out[5]:

```
numpy.uint8
```

In [ ]:

```
This implies there are 182*242 pixles in the given image
Each pixel is either 0 or 1
```

In [ ]:

```
2) Grayscale: Image is represented by intensity of white scale ranging from 0-255, 0 be
ing the darkest and 1 white.
    The pixel value tend to move towards white as the value increases
```

In [6]:

```python
from IPython.display import Image
Image(filename='E:\\Learning\\Computer_Vision\\opencv\\sources\\samples\\data\\lena_gra
yscale.jpg')
```

Out[6]:


```python
from IPython.display import Image
Image(filename='E:\\Learning\\Computer_Vision\\opencv\\sources\\samples\\data\\lena_gra
yscale.jpg')
```

In [7]:

```
img_gray = cv2.imread('E:\\Learning\\Computer_Vision\\opencv\\sources\\samples\\data\\l
ena_grayscale.jpg',0)
img_gray
```

Out[7]:

```
array([[163, 162, 161, ..., 168, 156, 129],
       [162, 162, 162, ..., 173, 157, 125],
       [162, 163, 163, ..., 169, 156, 127],
       ...,
       [ 43,  41,  51, ..., 102, 100,  99],
       [ 41,  42,  55, ..., 104, 105, 107],
       [ 42,  44,  58, ..., 101, 105, 109]], dtype=uint8)
```

In [8]:

```
#Here the resolution of image is:
img_gray.shape
```

Out[8]:

```
(512, 512)
```

In [9]:

```
#This implies there are 512*512 pixles in the given image
#Value of each pixel varies from 0 - 255
#This is a two dimentional numpy array of number
#We can access any pixel
img_gray[0][0]
```

Out[9]:

```
163
```

In [10]:

```
type(img_gray[0][0])
```

Out[10]:

```
numpy.uint8
```

In [11]:

```
#3) Color Image: Image is represented by intensity of Red, Green and Blue scale ranging
from 0-255.
  #  Color image is 3 two dimentional array, one array for each scale
```

In [12]:

```python
from IPython.display import Image
Image(filename='E:\\Learning\\Computer_Vision\\opencv\\sources\\samples\\data\\lena.jpg')
```

Out[12]:


```python
from IPython.display import Image
Image(filename='E:\\Learning\\Computer_Vision\\opencv\\sources\\samples\\data\\lena.jpg')
```

In [13]:

```
img_color = cv2.imread('E:\\Learning\\Computer_Vision\\opencv\\sources\\samples\\data\\
lena.jpg')
img_color
```

Out[13]:

```
array([[[128, 138, 225],
        [127, 137, 224],
        [126, 136, 224],
        ...,
        [126, 145, 236],
        [110, 129, 220],
        [ 86, 104, 197]],

       [[127, 137, 224],
        [127, 137, 224],
        [127, 137, 224],
        ...,
        [130, 150, 235],
        [112, 132, 217],
        [ 83, 102, 189]],

       [[127, 137, 224],
        [127, 137, 224],
        [128, 138, 225],
        ...,
        [127, 148, 230],
        [112, 133, 215],
        [ 85, 105, 190]],

       ...,

       [[ 55,  21,  82],
        [ 54,  20,  81],
        [ 62,  28,  92],
        ...,
        [ 82,  71, 175],
        [ 78,  68, 175],
        [ 74,  65, 175]],

       [[ 55,  18,  80],
        [ 56,  19,  81],
        [ 66,  32,  96],
        ...,
        [ 82,  69, 177],
        [ 80,  71, 181],
        [ 81,  72, 183]],

       [[ 56,  19,  81],
        [ 58,  21,  83],
        [ 68,  34,  98],
        ...,
        [ 81,  68, 176],
        [ 81,  72, 183],
        [ 84,  74, 188]]], dtype=uint8)
```

In [14]:

```python
#Resolution of image is:
img_color.shape
```

Out[14]:

```
(512, 512, 3)
```

In [ ]:

```
This imples there are 3 layers of 512*512 pixles but the image is 2 dimentional
```

In [15]:

```python
#Accessing the first pixle:
img_color[0][0]
# There values in the array represents BGR values
```

Out[15]:

```
array([128, 138, 225], dtype=uint8)
```

In [16]:

```python
#Each pixle is stored as 1-D numpy array of 3 value
type(img_color[0][0])
```

Out[16]:

```
numpy.ndarray
```

In [17]:

```python
img_color[0][0].shape
```

Out[17]:

```
(3,)
```