Sampling

In [1]:

```
%matplotlib inline
from matplotlib import pyplot as plt
import mxnet as mx
from mxnet import nd
import numpy as np
import math
```

In [2]:

```
import random
for i in range(10):
    print(random.random())
```

```
0.8778660335481027
0.6273669409016372
0.1916048679612935
0.09766200492928401
0.6482876396284325
0.7252315169394271
0.38240498644322407
0.6658533396231734
0.25690347700919525
0.3610061946649761
```

Uniform Distribution

In [3]:

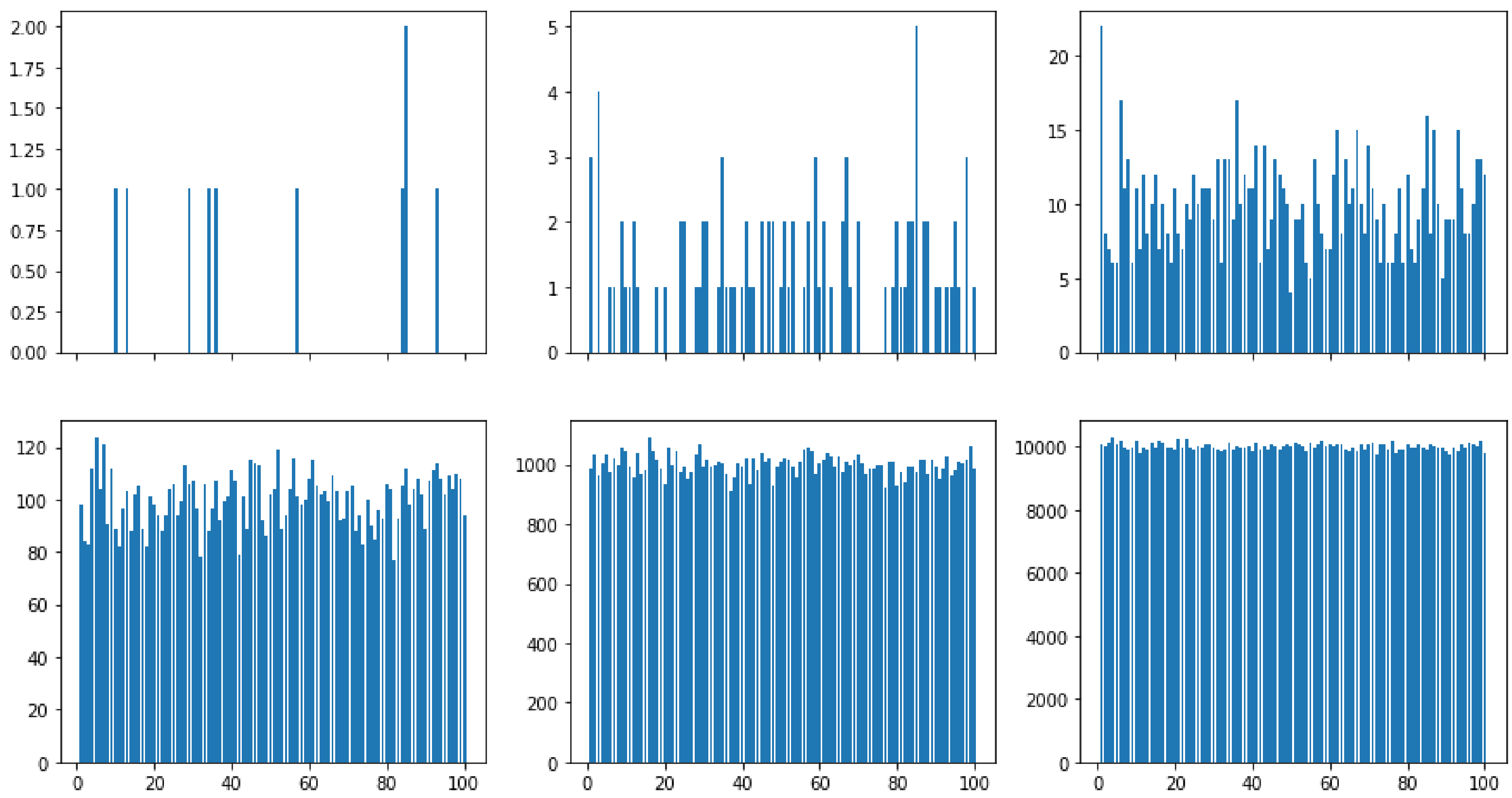
```
for i in range(10):
    print(random.randint(1, 100))
```

```
41
39
7
9
89
75
28
40
8
49
```

In [4]:

```
counts = np.zeros(100)
fig, axes = plt.subplots(2, 3, figsize=(15, 8), sharex=True)
axes = axes.reshape(6)

for i in range(1, 1000001):
    counts[random.randint(0, 99)] += 1
    if i in [10, 100, 1000, 10000, 100000, 1000000]:
        axes[int(math.log10(i))-1].bar(np.arange(1, 101), counts)
plt.show()
```



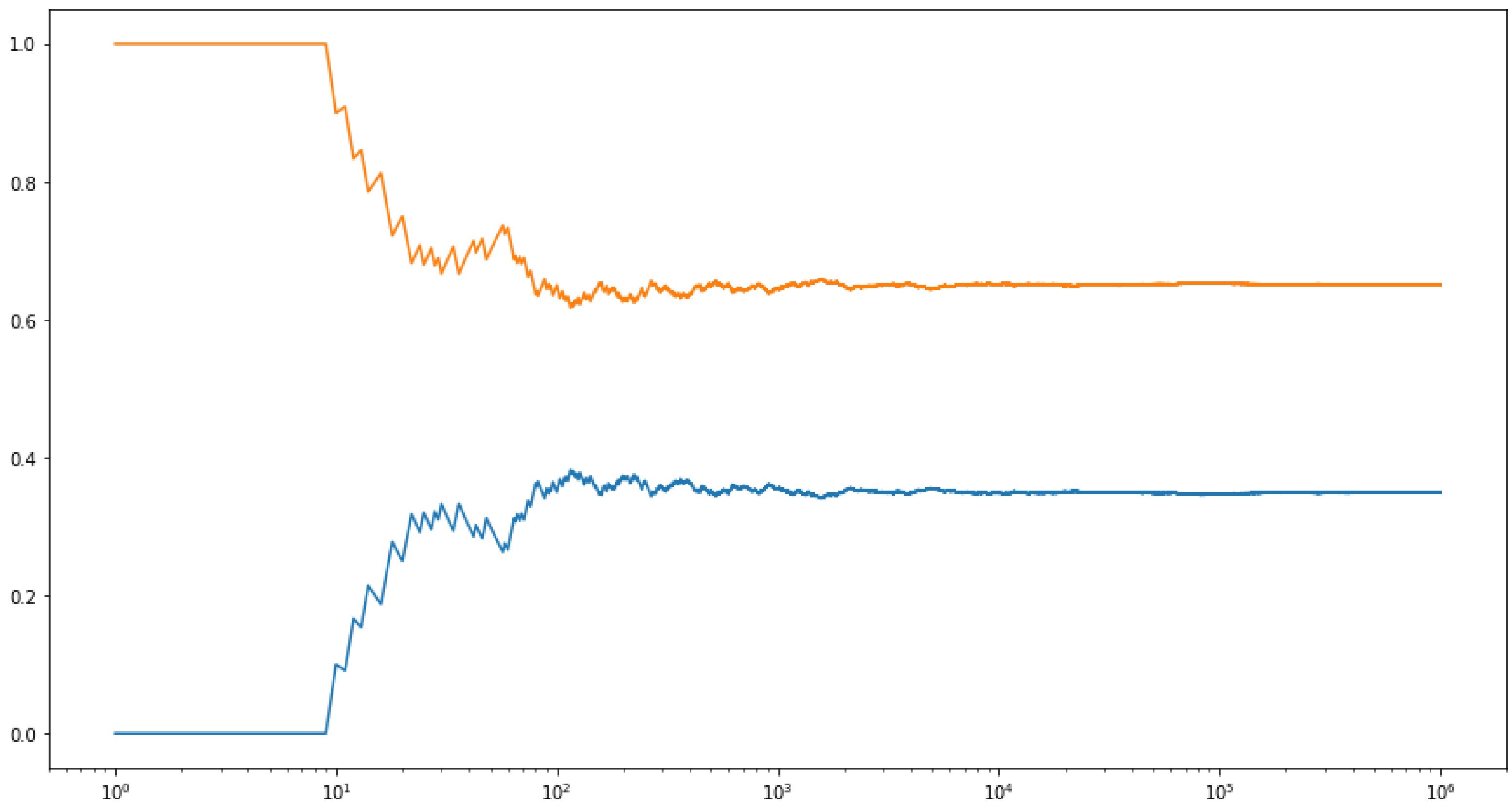
Categorical Distribution

In [5]:

```
# number of samples
n = 1000000
y = np.random.uniform(0, 1, n)
x = np.arange(1, n+1)
# count number of occurrences and divide by the number of total draws
p0 = np.cumsum(y < 0.35) / x
p1 = np.cumsum(y >= 0.35) / x
```

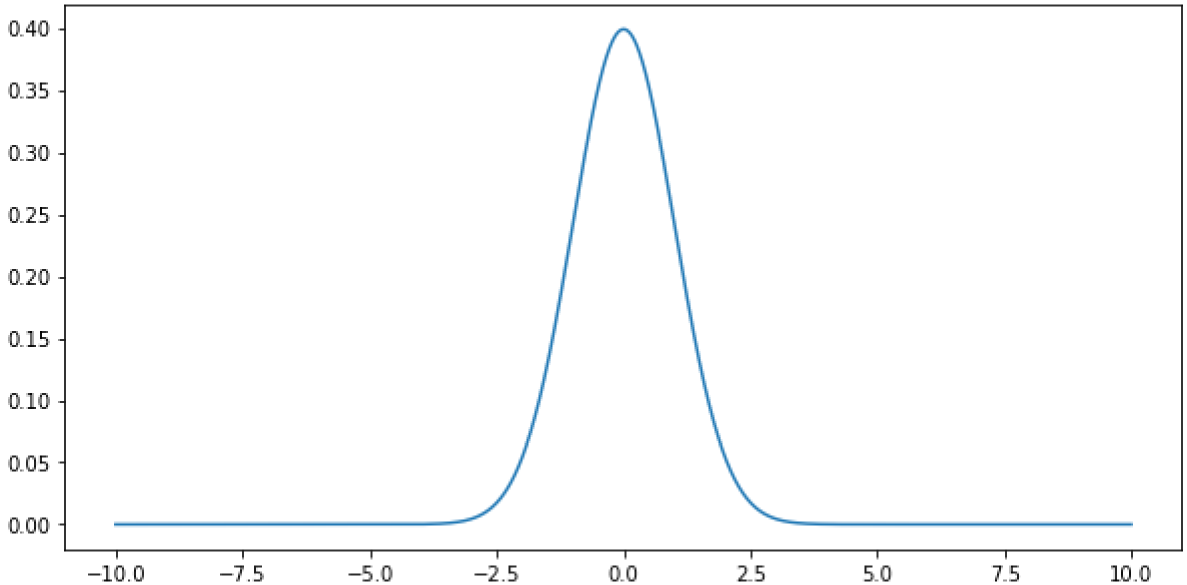
In [6]:

```
plt.figure(figsize=(15, 8))
plt.semilogx(x, p0)
plt.semilogx(x, p1)
plt.show()
```



Normal Distribution

In [7]:
```
x = np.arange(-10, 10, 0.01)
p = (1/math.sqrt(2 * math.pi)) * np.exp(-0.5 * x**2)
plt.figure(figsize=(10, 5))
plt.plot(x, p)
plt.show()
```



Central Limit Theorem in Action

In [8]:
```
# generate 10 random sequences of 10,000 uniformly distributed random variables
tmp = np.random.uniform(size=(10000,10))
x = 1.0 * (tmp > 0.3) + 1.0 * (tmp > 0.8)
mean = 1 * 0.5 + 2 * 0.2
variance = 1 * 0.5 + 4 * 0.2 - mean**2
print('mean {}, variance {}'.format(mean, variance))
# cumulative sum and normalization
y = np.arange(1,10001).reshape(10000,1)
z = np.cumsum(x,axis=0) / y
```

```
mean 0.9, variance 0.49
```

In [9]:

```
plt.figure(figsize=(10,5))
for i in range(10):
    plt.semilogx(y,z[:,i])

plt.semilogx(y,(variance**0.5) * np.power(y,-0.5) + mean,'r')
plt.semilogx(y,-(variance**0.5) * np.power(y,-0.5) + mean,'r')
plt.show()
```