HW9_7

In [4]:
```
# PYTHON ADD-ONS FOR ARRAYS, LINEAR ALGEBRA, STATS, RANDOM NUMBERS, ..
import numpy as np
import random
```

In [32]:
```
# #9_7

# INPUT N
N = 1000000
m = 4
msave = array('f', [])

for i in range (0,N):
    msave.append(np.random.rand())

a=0.0
for i in range (0,N):
    a = a+msave[i]**m

a = a/N
print(a)
```

```
0.20004675837285502
```

HW9_8

```
from array import *

# THIS IS NEEDED TO MAKE PLOTS IN PYTHON:
import matplotlib.pyplot as plt

# INPUTS
Nt= 100000 #int(input('Enter Nt:  \n'))
dt= .0001 #float(input('Enter dt:  \n'))
Nx= 1000 #int(input('Enter Nx:  \n'))
dx= .01 #float(input('Enter dx:  \n'))
D = .02 #float(input('Enter D :  \n'))

# DEFINE USEFUL CONSTANTSD
Ddtodx2= D*dt/(dx*dx)

# START OFF DENSITY ARRAYS
rho =array('f', [0.0])
for ix in range (1,Nx):
    rho.append(0.0)
rho.insert(int(Nx/2),1.0)

newrho =array('f', [0.0])
for ix in range (1,Nx):
    newrho.append(0.0)
newrho.insert(int(Nx/2),1.0)

# LOOP OVER TIME STEPS
for it in range (1,Nt):
    t=dt*it
    for ix in range (1,Nx):
        newrho[ix]=rho[ix]+Ddtodx2*(rho[ix-1]-2.*rho[ix]+rho[ix+1])
    for ix in range (1,Nx):
        rho[ix]=newrho[ix]


# OUTPUT FINAL DENSITY
for ix in range (0,Nx+1):
    x=dx*ix
    print(x,rho[ix])


#MAKE A PLOT
plt.plot([ix*dx for ix in range(0,Nx+1)],rho)
plt.xlabel('x')
plt.ylabel('rho')
plt.show()
```

```
9.98 8.797591239626543e-17
9.99 4.3664250645938663e-17
10.0 0.0
```

HW9_9

```
# THIS IS NEEDED TO MAKE PLOTS IN PYTHON:
import matplotlib.pyplot as plt

#fileout = open('HW9_8', 'w+')

Nt = int(input("Enter the Number of Iterations "))

dx = 0.10
dy = 0.10

V = np.zeros([31,21])
newV = np.zeros([31,21])

xsave = array('f', [])

iy = 20

for ix in range (1,31):
    V[ix][iy]=8.0

for it in range (1,Nt):
    for iy in range (1,20):
        for ix in range (1,30):
            newV[ix][iy]=0.25*(V[ix+1][iy]+ V[ix-1][iy]+V[ix][iy+1]+V[ix][iy-1])

    for iy in range (1,20):
        for ix in range (1,30):
            V[ix][iy] = newV[ix][iy]

for iy in range (0,21):
    y = dy * iy
    for ix in range (0,31):
        x = dx * ix
        xsave.append(x)

#potential at the center of the box
print('\n V at box center ',V[15][10])

#fileout.close()

plt.scatter(xsave, V)
plt.xlabel('x')
plt.ylabel('density')
plt.show()
```

```
Enter the Number of Iterations 50

 V at box center  0.3505669468199043
```