Monte Carlo methods

In [2]:
```
import numpy.random as npr
import numpy as np
a=1
b=1.5
c=(np.log(3)-np.log(2))**2
N=1000000
print('number of variates:', N)
X=npr.rand(2,N)
Z=[(np.log(a+(b-a)*X[0,i])**2>c*X[1,i])*1 for i in range(0,N)]
theta=np.mean(Z)*c*(b-a)
print("estimated value:", theta)
print("estimated value {:.7f}".format(theta))
theta_b=theta-(1/np.sqrt(N))*1.96*np.std(Z)*c*(b-a);
theta_h=theta+(1/np.sqrt(N))*1.96*np.std(Z)*c*(b-a);
print("confidence interval: lower {:.7f}, upper {:.7f}".format(theta_b,theta_h))
```

```
number of variates: 1000000
estimated value: 0.030210503047408098
estimated value 0.0302105
confidence interval: lower 0.0301328, upper 0.0302882
```

In [3]:
```
N=100000;
X=npr.randn(N)
Z=[np.exp(5*X[i])*(X[i]>0) for i in range(N)]
theta=np.mean(Z)
sigma=np.std(Z)
marge=1.96*sigma/np.sqrt(N)
print("estimated value: {:.4f}".format(theta))
print("margin: {:.4f}".format(marge))
print("confidence interval: lower {:.4f}, upper {:.4f}".format(theta-marge,theta
```

```
estimated value: 142079.3472
margin: 162065.4521
confidence interval: lower -19986.1050, upper 304144.7993
```

In [4]:
```
N=100000;
X=npr.randn(N)
W=[np.exp(25/2)*(X[i]+5>0) for i in range(N)]
A=[(X[i]+5>0) for i in range(N)]
theta1=np.mean(W)
sigma1=np.std(W)
marge1=1.96*sigma1/np.sqrt(N)
print("estimated value: {:.15f}".format(theta1))
print("margin:", marge1)
print("confidence interval: lower", theta1-marge1,  ", upper",theta1+marge1)
```

```
estimated value: 268337.286520874535199
margin: 3.6077482008433567e-13
confidence interval: lower 268337.28652087454 , upper 268337.28652087454
```

In [6]:
```
N=100000;
X=npr.randn(N)
R=[np.exp(25/2)-np.exp(5*X[i])*(X[i]<0) for i in range(N)]
#print(R)
theta2=np.mean(R)
sigma2=np.std(R)
```

```
marge2=1.96*sigma2/np.sqrt(N)
print("confidence interval: lower", theta2-marge2,  ", upper",theta2+marge2)
print("comparison of the margins :", 1.96*sigma/np.sqrt(N), 1.96*sigma1/np.sqrt(
```

```
confidence interval: lower 268337.2088204195 , upper 268337.2110815811
comparison of the margins : 518524.4469478968 3.6077482008433567e-13 0.0011305807
631627979
```

In [ ]: