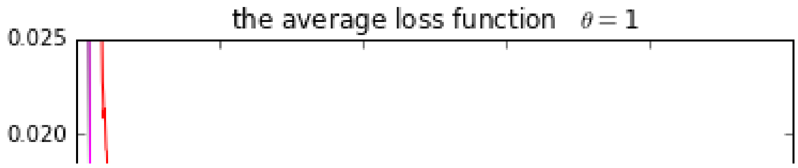
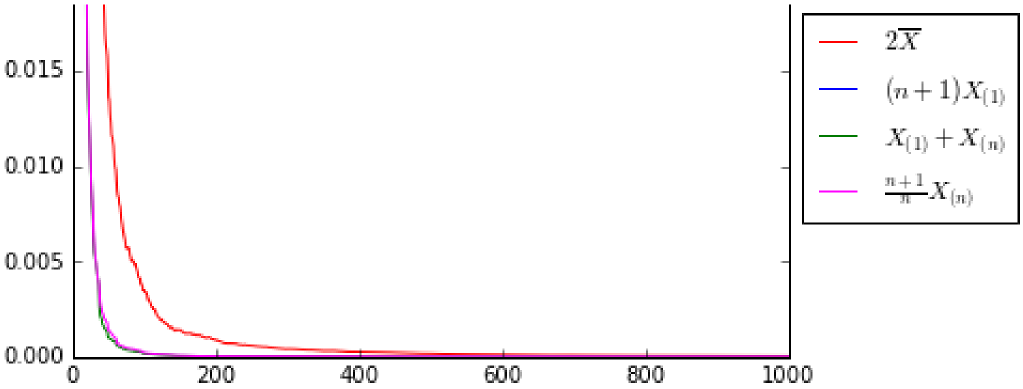
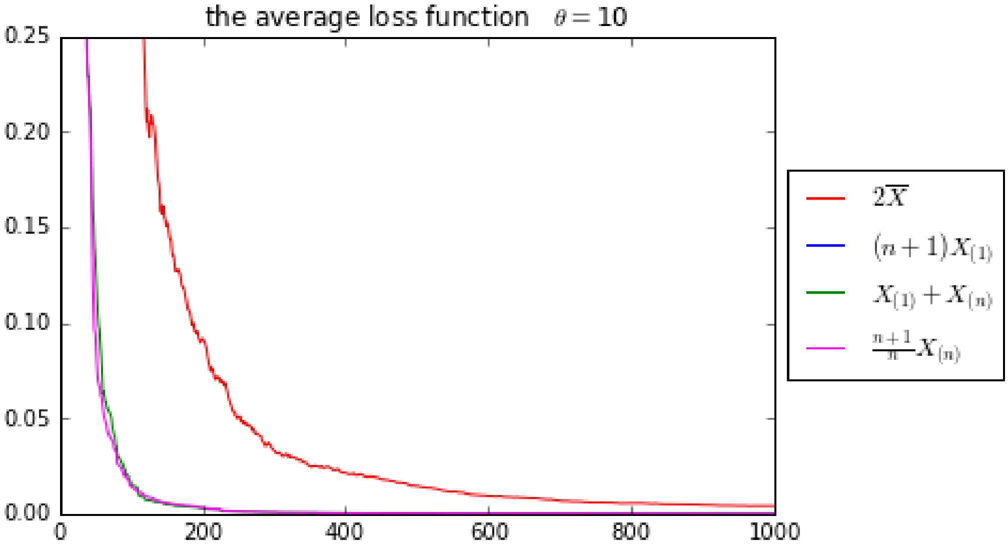
In [1]:

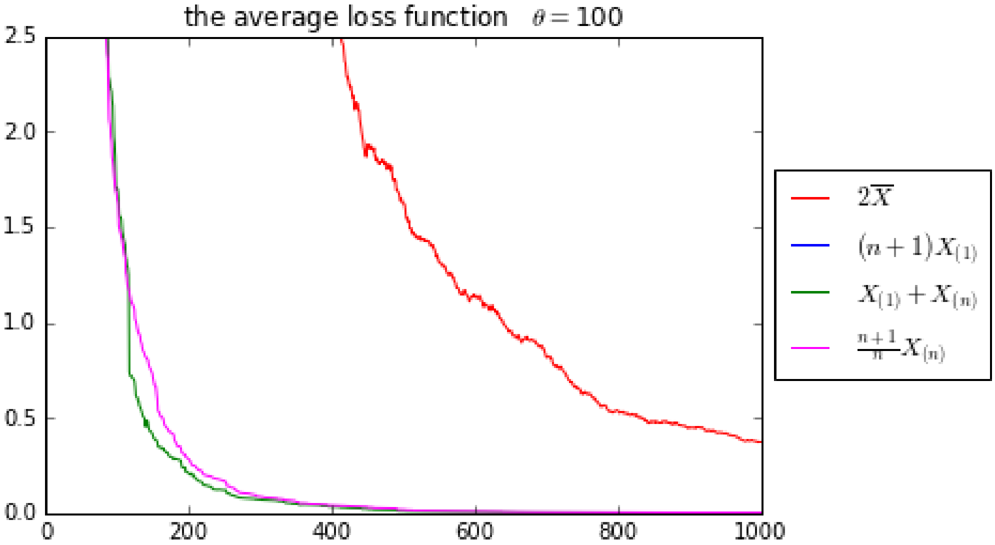
```
%pylab inline

import scipy.stats as sps
import numpy as np
import matplotlib.pyplot as plt

def func(theta):
    samples = np.zeros(100000).reshape(100, 1000)
    est1 = np.zeros(100000).reshape(100, 1000)
    est2 = np.zeros(100000).reshape(100, 1000)
    est3 = np.zeros(100000).reshape(100, 1000)
    est4 = np.zeros(100000).reshape(100, 1000)

    for i in range(100):
        samples[i] = sps.uniform.rvs(size=1000, loc=0, scale=theta)
        est1[i] = (2 * samples[i].cumsum() / np.arange(1, 1001) - theta) ** 2

        min_ar = np.zeros(1000)
        min_ar[0] = samples[i][0]
        max_ar = np.zeros(1000)
        max_ar[0] = samples[i][0]
        for n in range(1, 1000):
            min_ar[n] = min(min_ar[n - 1], samples[i][n])
            max_ar[n] = max(max_ar[n - 1], samples[i][n])

        est2[i] = ((np.arange(1, 1001) + 1) * min_ar - theta) ** 2
        est3[i] = (min_ar + max_ar - theta) ** 2
        est4[i] = ((1 + np.arange(1, 1001) ** (-1)) * max_ar - theta) ** 2

    est1_av = est1.sum(axis=0) / np.arange(1, 1001)
    est2_av = est2.sum(axis=0) / np.arange(1, 1001)
    est3_av = est3.sum(axis=0) / np.arange(1, 1001)
    est4_av = est4.sum(axis=0) / np.arange(1, 1001)

    plt.ylim((0, theta * 0.025))
    plt.title('the average loss function   ' + r'$\theta=$' + str(theta))
    plt.plot(np.arange(1, 1001), est1_av, color='red', label='$2\overline{X}$'
    plt.plot(np.arange(1, 1001), est2_av, color='blue', label='$(n+1)X_{(1)}$'
    plt.plot(np.arange(1, 1001), est3_av, color='green', label='$X_{(1)}+X_{(n
    plt.plot(np.arange(1, 1001), est4_av, color='magenta', label=r'$\frac{n+1}
    plt.legend(loc='center left', bbox_to_anchor=(1, 0.5))
    plt.show()

func(1)
func(10)
func(100)
```

```
Populating the interactive namespace from numpy and matplotlib
```




0.015
0.010
0.005
0.000
0
200
400
600
800
1000
$2\overline{X}$
$(n+1)X_{(1)}$
$X_{(1)}+X_{(n)}$
$\frac{n+1}{n}X_{(n)}$


the average loss function $\theta=10$
0.25
0.20
0.15
0.10
0.05
0.00
0
200
400
600
800
1000
$2\overline{X}$
$(n+1)X_{(1)}$
$X_{(1)}+X_{(n)}$
$\frac{n+1}{n}X_{(n)}$


the average loss function $\theta=100$
2.5
2.0
1.5
1.0
0.5
0.0
0
200
400
600
800
1000
$2\overline{X}$
$(n+1)X_{(1)}$
$X_{(1)}+X_{(n)}$
$\frac{n+1}{n}X_{(n)}$