

In [1]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import scipy.stats as sts
%matplotlib inline
```

In [136]:

```
N = 10000

# theta - параметр мемa
# scale - размер
def showGraphs(theta, scale, e1, e2, e3, e4, e5):
    sample = sts.uniform(0, theta).rvs(N)

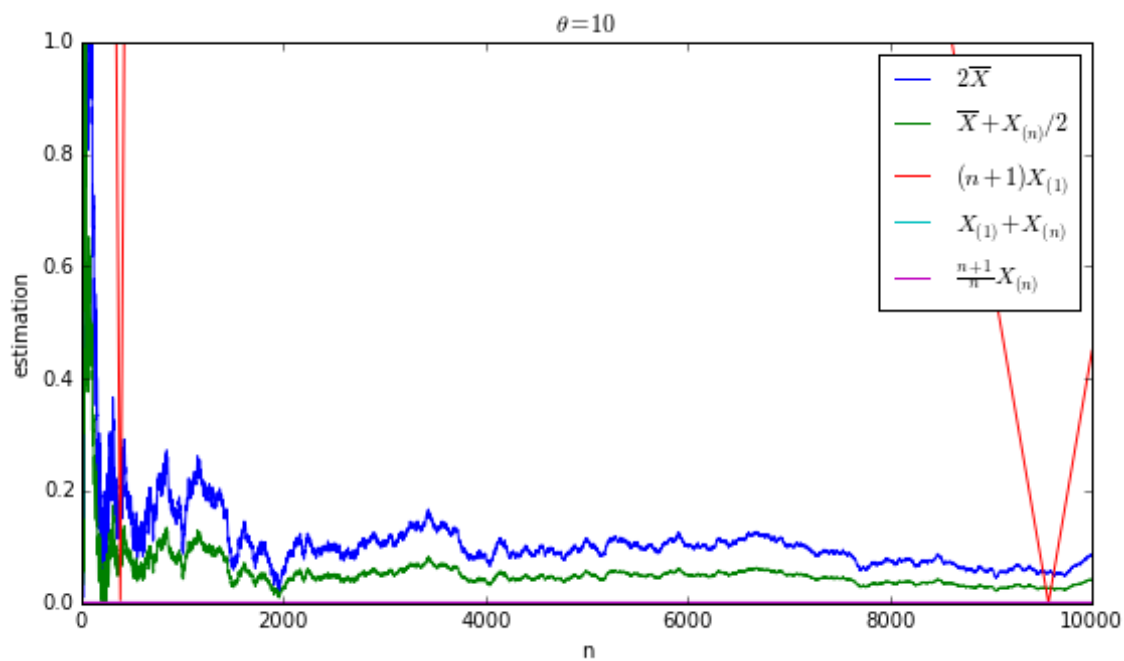
    x = np.arange(1, N + 1)
    y1 = np.zeros(N) # 2X
    y2 = np.zeros(N) #  $X + X(n)/2$ 
    y3 = np.zeros(N) #  $(n + 1) * X(1)$ 
    y4 = np.zeros(N) #  $X(1) + X(n)$ 
    y5 = np.zeros(N) #  $((n + 1)/n) * X(n)$ 

    for n in range(1, N):
        samplePart = sample[:n]
        y1[n] = abs(theta - (samplePart.mean() * 2.0))
        y2[n] = abs(theta - (samplePart.mean() + samplePart.max() * 0.5))
        y3[n] = abs(theta - ((n + 1) * samplePart.min()))
        y4[n] = abs(theta - (sample.min() + sample.max()))
        y5[n] = abs(theta - ((n + 1) / n * sample.max()))

    plt.figure(figsize=(9, 5))
    if (e1):
        plt.plot(x, y1, label='$2\overline{X}$')
    if (e2):
        plt.plot(x, y2, label='$\overline{X} + X_{(n)}/2$')
    if (e3):
        plt.plot(x, y3, label='$ (n + 1) X_{(1)} $')
    if (e4):
        plt.plot(x, y4, label='$X_{(1)} + X_{(n)}$')
    if (e5):
        plt.plot(x, y5, label='$\frac{n + 1}{n} X_{(n)}$')
    plt.legend()
    plt.ylim((0, scale))
    plt.xlabel('n')
    plt.ylabel('estimation')
    plt.title('$\theta = ' + str(theta) + '$')
    plt.show()
    print("Delta for n = N:")
    print(y1[-1], y2[-1], y3[-1], y4[-1], y5[-1])
```

In [144]:

```
showGraphs(10, 1, True, True, True, True, True)
```



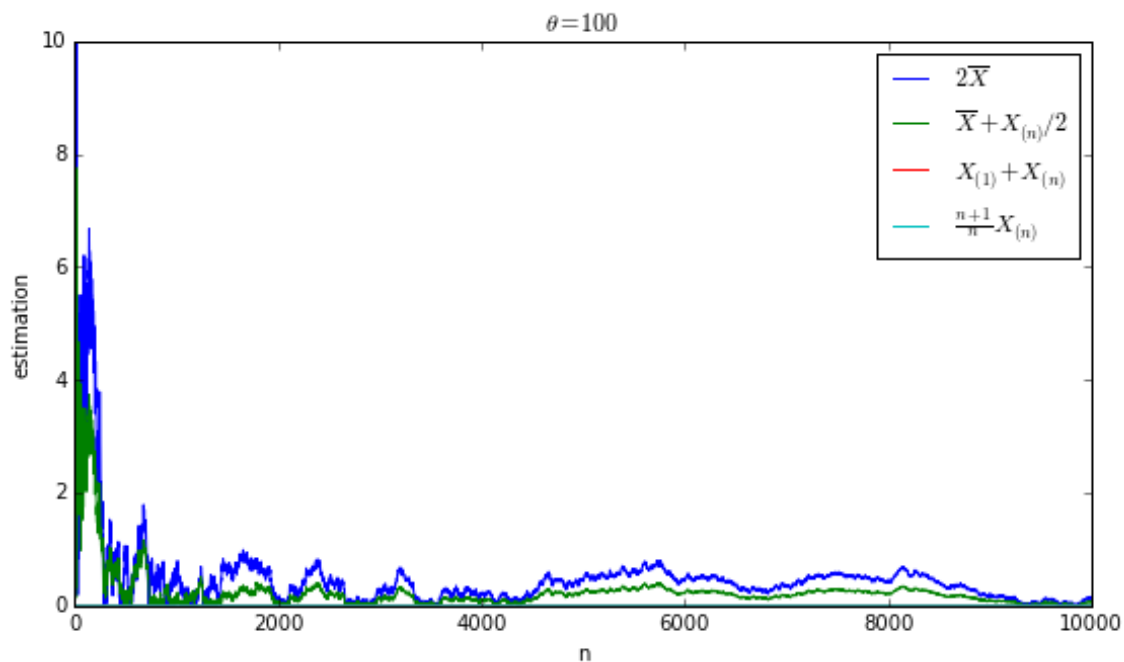
Delta for $n = N$:

(0.084854464010945208, 0.041717548766541768, 0.44993087404577636, 0.003743733904570945, 0.0014193664778616721)

Оценка $(n+1)X_{(1)}$ очень плохая, не будем ее показывать

In [145]:

```
showGraphs(100, 10, True, True, False, True, True)
```

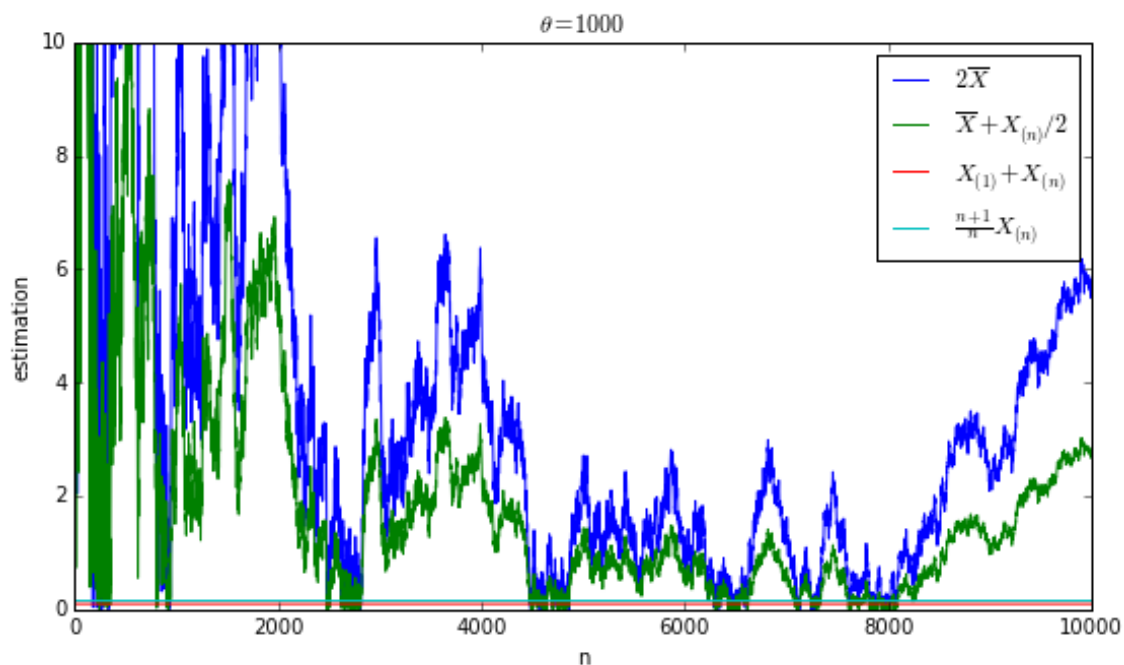


Delta for $n = N$:

(0.12481766993725785, 0.06198178734913995, 70.300771355735662, 0.0021158276254453767, 0.0008540952389779477)

In [146]:

```
showGraphs(1000, 10, True, True, False, True, True)
```



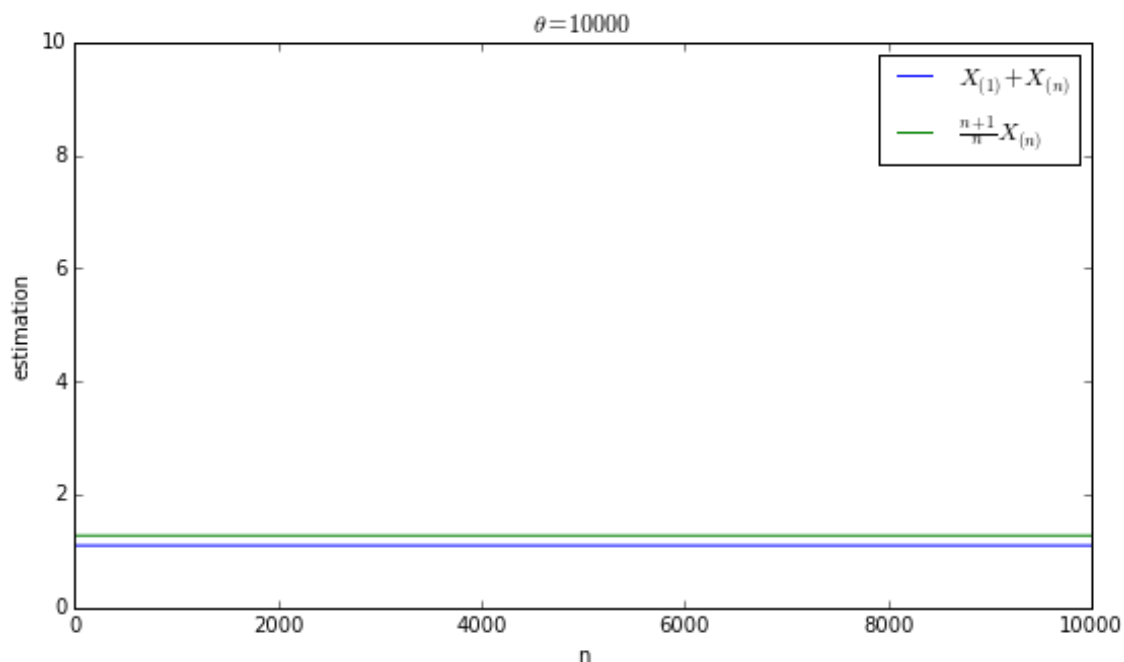
Delta for n = N:

(5.7859949480952082, 2.8168662806872362, 446.95650859971533, 0.096958037580861856, 0.15226238672084946)

Оценки $2\bar{X}$ и $\bar{X} + X_{(n)}/2$ тоже заметно хуже остальных

In [147]:

```
showGraphs(10000, 10, False, False, False, True, True)
```



Delta for n = N:

(31.995217938503629, 15.360533415630925, 8250.9509254269269, 1.0992461997866485, 1.2741511072435969)

Лучшие оценки - $X_{(1)} + X_{(n)}, \frac{n+1}{n} X_{(n)}$

In []: