

# 作业三

## 理论推导

$$f(x) = A \exp\left(-\frac{x^2}{2}\right)$$

$$\text{归一化条件 } \int_{-\infty}^{\infty} f(x) dx = 1$$

$$A = \frac{1}{\int_{-\infty}^{\infty} \exp\left(-\frac{x^2}{2}\right) dx} = \frac{1}{\sqrt{2\pi}}$$

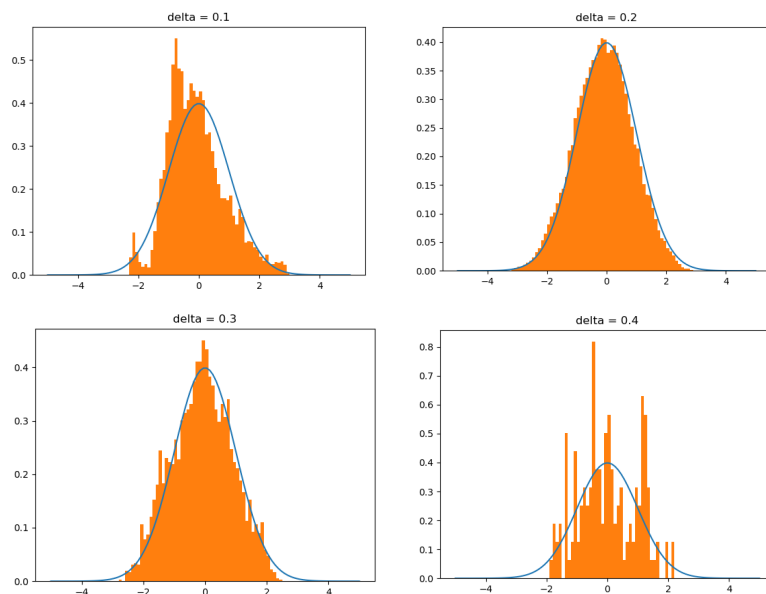
A的值不需要知道

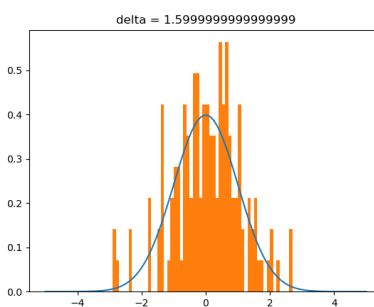
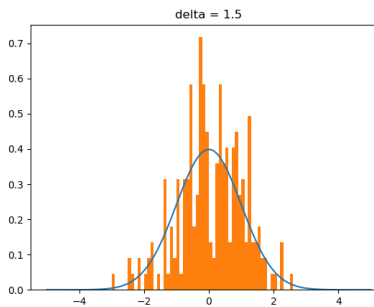
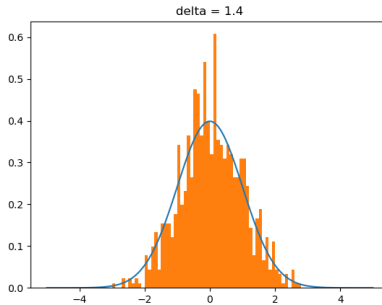
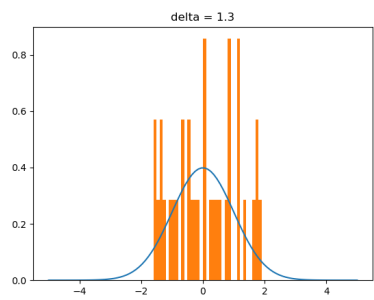
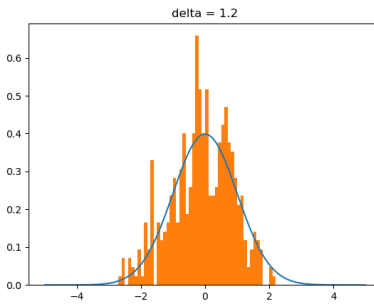
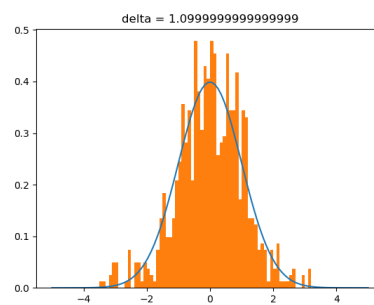
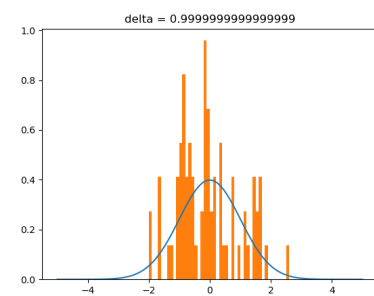
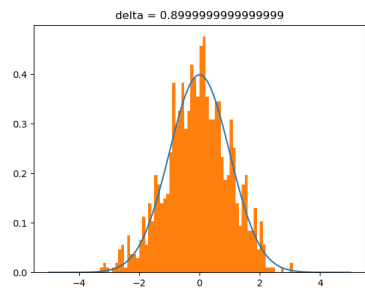
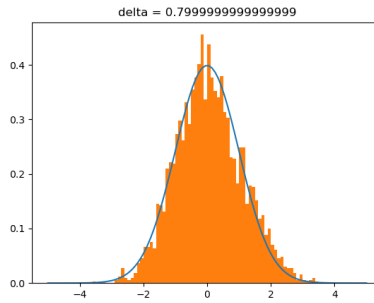
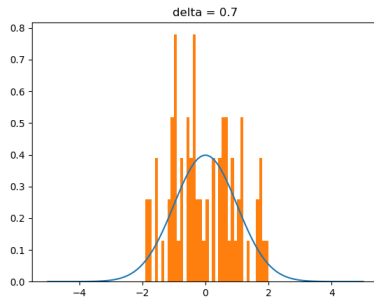
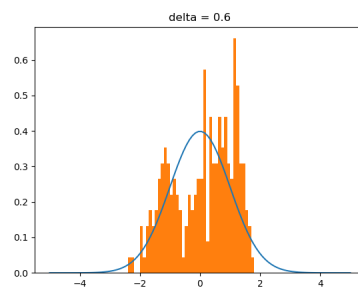
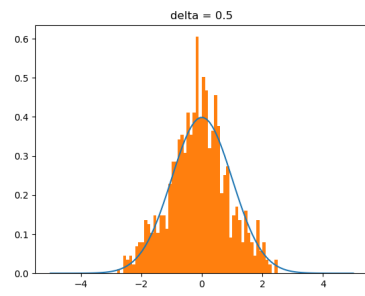
## 代码说明

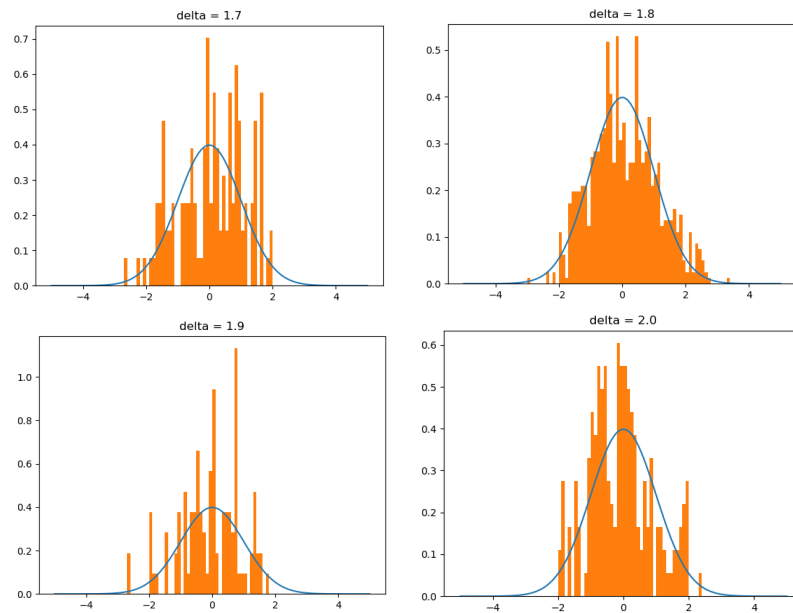
包含高斯抽样函数，抽样结果作图函数。运行该程序，从命令行传入参数，可调用前述两函数得到结果。具体见注释

## 运行结果

设置delta下限0.1，上限2.0，中间取20个点，对于x均值和x的平方均值，epsilon均取0.01.抽样结果如下图

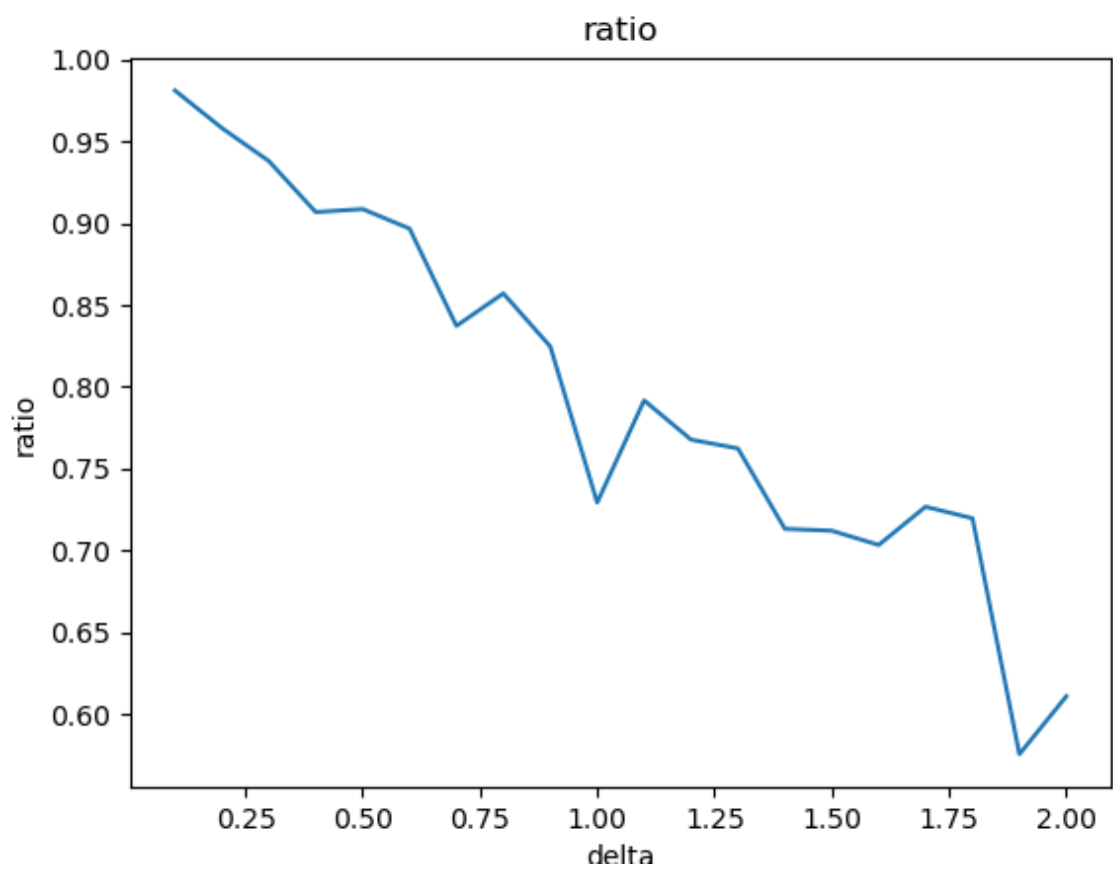
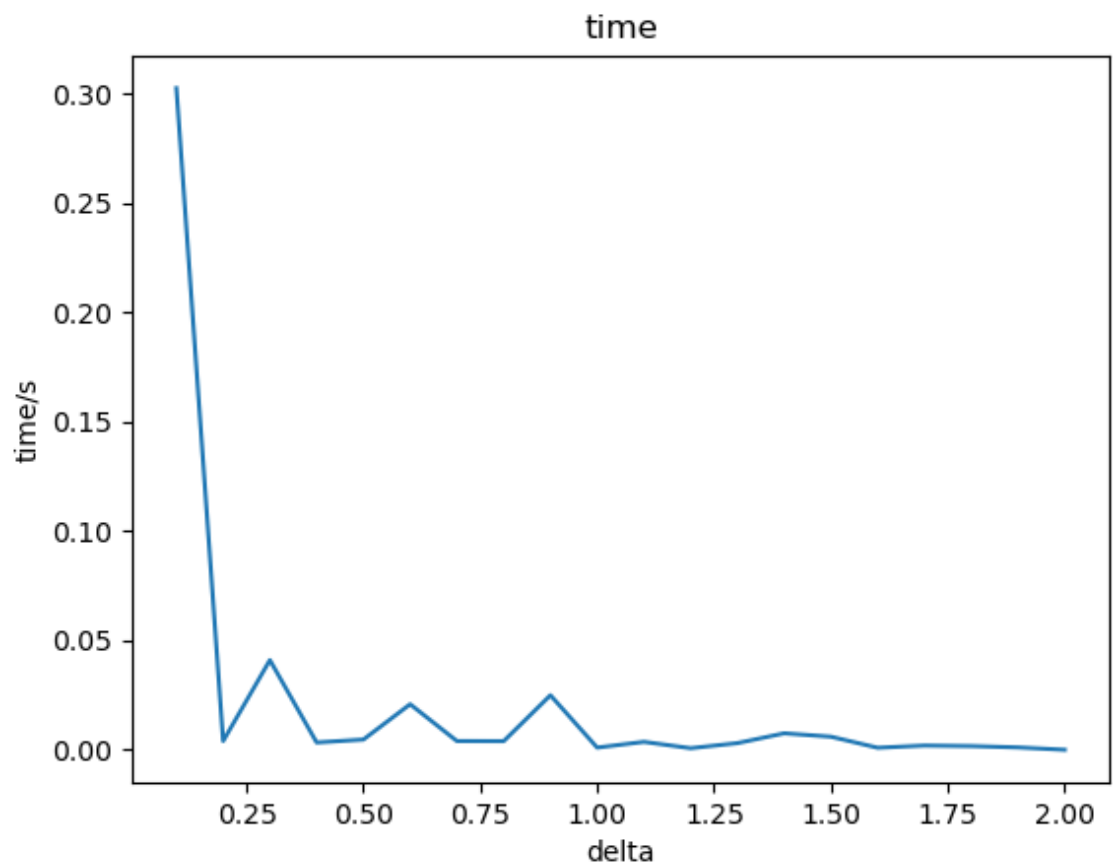






所测得时间和accept/try比值如下,分别作图

```
delta = 0.1: time = 0.3025383949279785s, ratio = 0.9810497963895213
delta = 0.2: time = 0.003991365432739258s, ratio = 0.958109559613319
delta = 0.3: time = 0.041005849838256836s, ratio = 0.9379769443091411
delta = 0.4: time = 0.0033409595489501953s, ratio = 0.906801007556675
delta = 0.5: time = 0.004683494567871094s, ratio = 0.9086378737541528
delta = 0.6: time = 0.0208282470703125s, ratio = 0.896696137738483
delta = 0.7: time = 0.003987550735473633s, ratio = 0.8373101952277657
delta = 0.7999999999999999: time = 0.003946065902709961s, ratio = 0.8571428571428571
delta = 0.8999999999999999: time = 0.024932861328125s, ratio = 0.8247011952191236
delta = 0.9999999999999999: time = 0.000997781753540039s, ratio = 0.7294117647058823
delta = 1.0999999999999999: time = 0.003625631332397461s, ratio = 0.7917981072555205
delta = 1.2: time = 0.0007159709930419922s, ratio = 0.7678571428571429
delta = 1.3: time = 0.003048419952392578s, ratio = 0.7624703087885986
delta = 1.4: time = 0.007529020309448242s, ratio = 0.7133592736705577
delta = 1.5: time = 0.005983114242553711s, ratio = 0.7122302158273381
delta = 1.5999999999999999: time = 0.0009233951568603516s, ratio = 0.7035175879396985
delta = 1.7: time = 0.0019383430480957031s, ratio = 0.7268722466960352
delta = 1.8: time = 0.0016891956329345703s, ratio = 0.7197802197802198
delta = 1.9: time = 0.0010802745819091797s, ratio = 0.5757575757575758
delta = 2.0: time = 0.0s, ratio = 0.6111111111111112
```



执行多次，发现每次结果不同，抽样图像与time-delta，ratio-delta曲线均有较大涨落，总体趋势为time和ratio均随delta的下降而下降。

保持delta不变，改变epsilon为0.1或0.001，发现图像与理论曲线严重不符。调节delta为0.1至1.0，间隔0.1，同样对三种epsilon测试，同样发现仅有epsilon=0.01时图像较为平滑。epsilon越大，迭代次数越小，time越小，ratio无明显规律

总共发现了两个点效果较好, epsilon均取0.01, 如图

