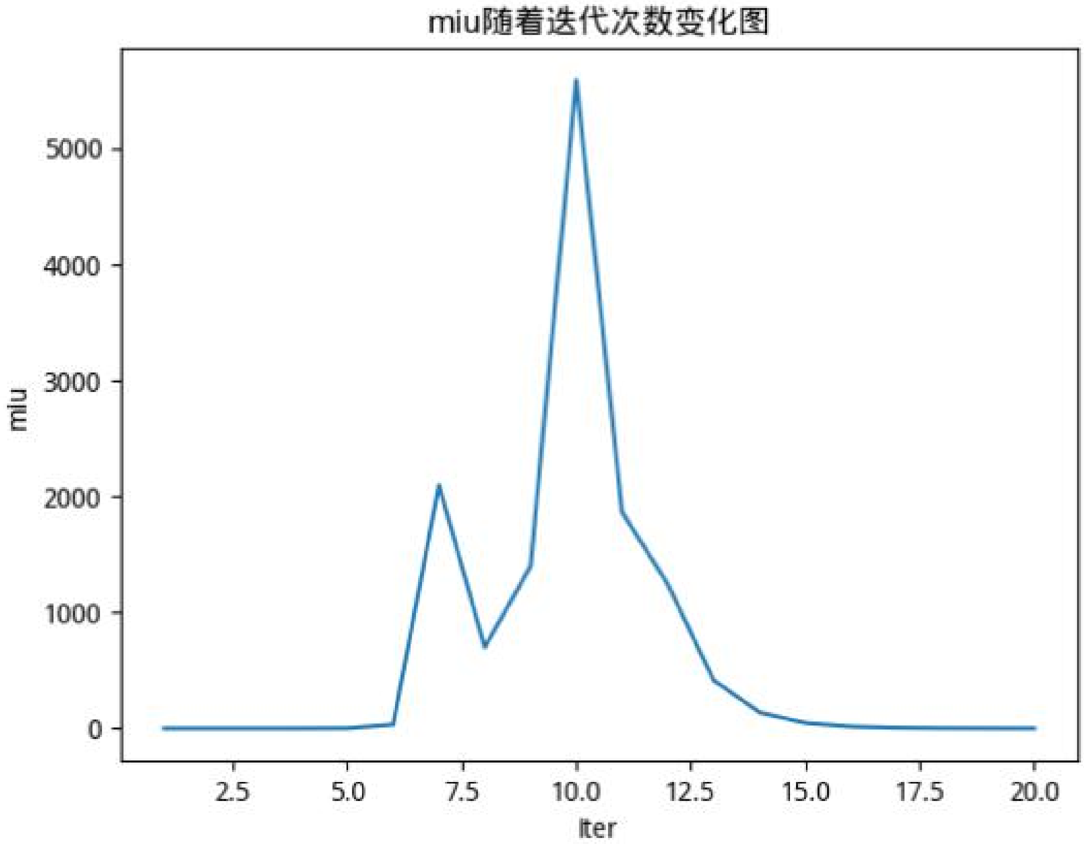
2.

```
import numpy as np
import matplotlib.pyplot as plt
plt.rcParams['font.sans-serif'] = ['Droid Sans Fallback'] #设置中文字体
plt.rcParams['axes.unicode_minus']=False #正确显示负号
tmp = range(1, 21)
x = np.array(tmp)
print(x)
y = np.loadtxt('lambda.txt', unpack=True, dtype=float, usecols=0)
##plt.scatter(x, y, s=0.5, c='r', alpha=1)
plt.plot(x,y)
plt.title('miu随着迭代次数变化图')
plt.xlabel('iter')
plt.ylabel('miu')
plt.show()
```



3. 公式推导：

$$f_{15} = \frac{\partial \alpha_{b_i b_{k+1}}}{\partial \delta b_k^g} = \frac{\partial(\alpha_{b_i b_k} + \beta_{b_i b_k} t + \frac{1}{2} a\delta t^2)}{\partial \delta b_k^g} = \frac{1}{2}\frac{\partial a}{\partial \delta b_k^g}\delta t^2$$

$$\because \frac{\partial a \delta t}{\partial \delta b_k^g} = \frac{1}{2}\frac{\partial [q_{b_i b_{k+1}} \otimes \begin{bmatrix}1 \\ -\frac{1}{2}\delta b_k^g \delta t^2\end{bmatrix}(a^{b_{k+1}} - b_k^a)]}{\partial \delta b_k^g}$$

$$= \frac{1}{2}\cdot\left[\frac{\partial R_{b_i b_{k+1}} \exp[-\delta b_k^g \delta t]_\times (a^{b_{k+1}} - b_k^a)}{\partial \delta b_k^g}\right]$$

$$= \frac{1}{2}\left[\frac{\partial R_{b_i b_{k+1}} [-\delta b_k^g \delta t]_\times (a^{b_{k+1}} - b_k^a)}{\partial \delta b_k^g}\right]$$

$$= -\frac{1}{2}\frac{\partial R_{b_i b_{k+1}} (a^{b_{k+1}} - b_k^a)_\times [-\delta b_k^g \delta t]}{\partial \delta b_k^g} = -\frac{1}{2} R_{b_i b_{k+1}} (a^{b_{k+1}} - b_k^a)_\times (-\delta t)$$

从而 $\frac{\partial \alpha_{b_i b_{k+1}}}{\partial \delta b_k^g} = -\frac{1}{4} R_{b_i b_{k+1}} [(a^{b_{k+1}} - b_k^a)\delta t^2](-\delta t)$

为f15 bais对于误差的影响是 $\frac{1}{2}$ 而噪声的影响是 $\frac{1}{4}$ 呢，已解决

$$g_{12} = \frac{\partial \alpha_{b_i b_{k+1}}}{\partial n_k^g} = \frac{1}{2}\frac{\partial a}{\partial \delta n_k^g}\delta t^2$$

$$\because \frac{\partial a}{\partial \delta n_k^g} = \frac{1}{2}\frac{\partial [q_{b_i b_{k+1}} \otimes \begin{bmatrix}1 \\ \frac{1}{4}\delta n_k^g \delta t^2\end{bmatrix}(a^{b_{k+1}} - b_k^a)]}{\partial \delta n_k^g}$$

从而 与上式同

$$\Rightarrow \frac{\partial \alpha_{b_k b_{k+1}}}{\partial \delta b_k^g} = -\frac{1}{4} R_{b_i b_{k+1}} [(a^{b_{k+1}} - b_k^a)\delta t^2](-\frac{1}{2}\delta t)$$

4. 证明：

推导 $\Delta X_{lm} = -\sum_{j=1}^{n} \frac{v_j^T F'^T}{a_j + \mu} v_j$

$-(f^T J)^T = -(F')^T$

∵ $(J^T J + \mu I)\Delta X_{lm} = -J^T f$ $\mu \geq 0$

$\Rightarrow \Delta X_{lm} = (J^T J + \mu I)^{-1}(-F'^T)$

对 $J^T J$ 进行特征值分解有：$J^T J = \sum_{j=1}^{n} \lambda_j v_j v_j^T$

从而 $(J^T J + \mu I)^{-1} = \sum_{j=1}^{n} \frac{1}{\lambda_j + \mu} v_j v_j^T$

从而 $\Delta X_{lm} = -\sum_{j=1}^{n} \frac{v_j v_j^T F'^T}{\lambda_j + \mu}$

$= -\sum_{j=1}^{n} \frac{v_j^T F'^T v_j}{\lambda_j + \mu}$

$v_j^T F'^T$ 是一个数可交换 $= F'^T v_j^T$