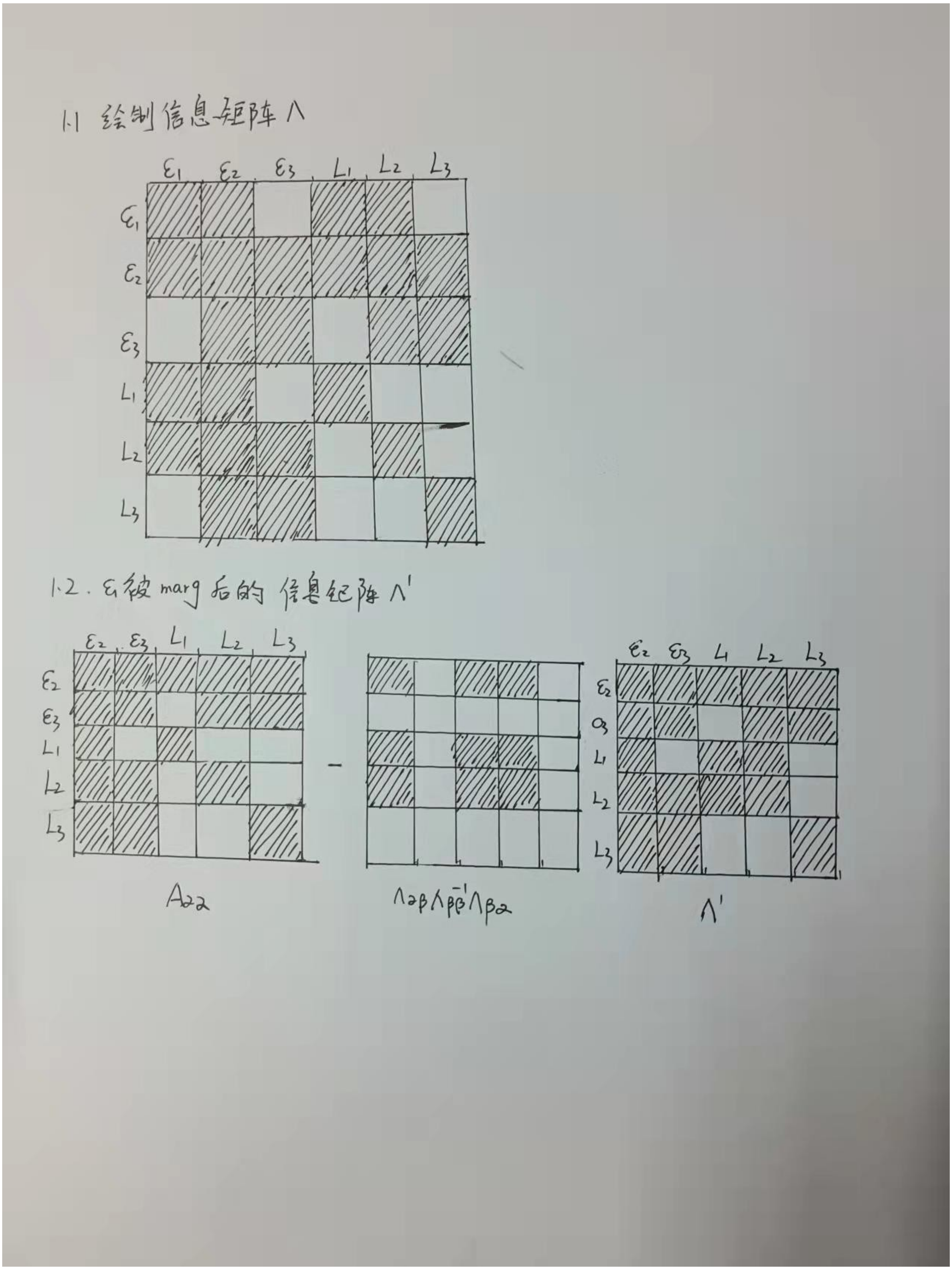
1.1-1.2 如下



2 证明如下

2. 证明如下：

$$p(\theta) = (2\pi)^{-\frac{N_\theta}{2}} |\Sigma_\theta|^{-\frac{1}{2}} \exp\left[-\frac{1}{2}(\theta-\theta^*)^T \Sigma_\theta^{-1}(\theta-\theta^*)\right]$$

$$J(\theta) = -\ln p(\theta) = \frac{N_\theta}{2}\ln 2\pi + \frac{1}{2}\ln|\Sigma_\theta| + \frac{1}{2}(\theta-\theta^*)^T \Sigma_\theta^{-1}(\theta-\theta^*)$$

$$H^{(l,l')}(\theta^*) = \frac{\partial^2 J(\theta)}{\partial\theta_l \partial\theta_{l'}}\Big|_{\theta=\theta^*} = \left[\frac{\partial}{\partial\theta_l}\left(\frac{\partial J(\theta)}{\partial\theta_l}\right)\right]_{\theta=\theta^*} = \left[\frac{\partial J'(\theta)}{\partial\theta_l}\right]_{\theta=\theta^*}$$

对J(θ)求一次偏导，得

$$dJ = \left(\frac{1}{2}d\theta\right)^T\left(\Sigma_\theta^{-1}\theta - \Sigma_\theta^{-1}\theta^*\right) + \frac{1}{2}(\theta-\theta^*)^T\left(\Sigma_\theta^{-1}d\theta\right)$$

$$= \left(\Sigma_\theta^{-1}\theta - \Sigma_\theta^{-1}\theta^*\right)^T\left(\frac{1}{2}d\theta\right) + \frac{1}{2}(\theta-\theta^*)^T\left(\Sigma_\theta^{-1}d\theta\right)$$

$$= \left(\Sigma_\theta^{-1}(\theta-\theta^*)\right)^T\left(\frac{1}{2}d\theta\right) + \frac{1}{2}(\theta-\theta^*)^T\left(\Sigma_\theta^{-1}d\theta\right)$$

$$= (\theta-\theta^*)^T\left(\Sigma_\theta^{-1}\right)^T\left(\frac{1}{2}d\theta\right) + \frac{1}{2}(\theta-\theta^*)^T\left(\Sigma_\theta^{-1}d\theta\right)$$

$$= \frac{1}{2}(\theta-\theta^*)^T\left(\Sigma_\theta^{-1}\right)^T(d\theta) + \frac{1}{2}(\theta-\theta^*)\Sigma_\theta^{-1}(d\theta)$$

$$= \frac{1}{2}(\theta-\theta^*)^T\Sigma_\theta^{-1}(d\theta) + \frac{1}{2}(\theta-\theta^*)\Sigma_\theta^{-1}(d\theta)$$

$$= (\theta-\theta^*)\Sigma_\theta^{-1}(d\theta)$$

$$\frac{\partial J}{\partial\theta} = \left(\Sigma_\theta^{-1}\right)^T(\theta-\theta^*) = J'(\theta)$$

则 $$\frac{\partial J'}{\partial\theta} = \Sigma_\theta^{-1}$$

3 代码和结果如下

```
H.block(i*6,i*6,6,6) += jacobian_Ti.transpose() * jacobian_Ti;
H.block(i*6, poseNums*6+j*3, 6, 3) += jacobian_Ti.transpose() * jacobian_Pj;
H.block(poseNums*6+j*3, i*6, 3, 6) += jacobian_Pj.transpose() * jacobian_Ti;
H.block(poseNums*6+j*3, poseNums*6+j*3, 3, 3) += jacobian_Pj.transpose() * jacobian_Pj;
```

```
3.21708e-17
2.06732e-17
1.43188e-17
7.66992e-18
6.08423e-18
6.05715e-18
3.94363e-18
```