$$p(\theta|y) \propto (2+\theta)^{y_1}(1-\theta)^{y_2+y_3}\,\theta^{y_4} = \tilde{p}(\theta|y)$$

$$\log \tilde{p}(\theta|y) = y_1 \log(2+\theta) + (y_2+y_3)\log(1-\theta) + y_4 \log\theta$$

$$\frac{d}{d\theta}\log\tilde{p}(\theta|y) = \frac{y_1}{2+\theta} - \frac{y_2+y_3}{1-\theta} + \frac{y_4}{\theta}$$

$$\frac{d^2}{d\theta^2}\log \tilde{p}(\theta|y) = -\frac{y_1}{(2+\theta)^2} - \frac{y_2+y_3}{(1-\theta)^2} - \frac{y_4}{\theta^2}$$

$$\hat{S} = \left[-\frac{d^2}{d\theta^2}\log\tilde{p}(\theta|y)\right]^{-\frac{1}{2}}\Bigg|_{\theta=\hat{\theta}} \qquad \hat{\theta} = \underset{\theta}{\arg\max}\ \tilde{p}(\theta|y)$$

$$= \left[\frac{y_1}{(2+\hat{\theta})^2} + \frac{y_2+y_3}{(1-\hat{\theta})^2} + \frac{y_4}{\hat{\theta}^2}\right]^{-\frac{1}{2}}$$