22.1)

$\because L(\mu, x) = e^{n\mu - \sum x_i}$

$\therefore \dfrac{\partial L}{\partial \mu} = ne^{n\mu - \sum x_i}(ln(n\mu - \sum x_i))$

$\therefore \hat{\mu}^* = (\sum x_i + 1)/n > X_{(1)}$

$\therefore \hat{\mu}^* = X_{(1)}$

不是无偏估计

$E(\hat{\mu}^*) = \mu + 1$

$\therefore \hat{\mu}^{**} = X_{(1)} - 1$

22.2)

$\because E(x) = \mu + 1$

$\therefore \hat{\mu} = \overline{X} - 1$

$\because E(\hat{\mu}) = \mu$

是无偏估计

22.3)

$\because Var(\hat{\mu}^{**}) = 1, Var(\hat{\mu}) = 1/n$

后者更有效

24)

$L(\sigma^2, x) = (\dfrac{1}{\sqrt{2n}\sigma})^n exp\{\sum -\dfrac{(x_i - \mu_1)^2}{2\sigma^2}\}$

$lnL = nln(\dfrac{1}{\sqrt{2n}\sigma}) - \sum \dfrac{(x_i - \mu_1)^2}{2\sigma^2}$

$\because \dfrac{\partial lnL}{\partial \sigma^2} = 0$

$\therefore \hat{\sigma}^2 = \frac{1}{n}\sum(x_i - \overline{X})^2$

$\because E(\hat{\sigma}^2) = \frac{n}{n-1}\sigma^2 \to \sigma^2$

$\therefore$是弱相合估计

25)

设k为X_i中有理数的个数

$L(\theta,x)=\theta^k(1-\theta)^{n-k}$

$l(\theta,x)=kln\theta+(n-k)ln(1-\theta)$

$\therefore \hat{\theta}^*=k/n$

因为无理数基数大于有理数，所以不是相合估计