P_1: (a) $a < x^{(m)} < b$

$$L(a,b;D) = P(\cancel{\ \ }D;a,b) = \prod_{m=1}^{M} P(x^{(m)}|a,b)$$

$$= \prod_{m=1}^{M} \left(\frac{1}{b-a}\right)$$

$$= \left(\frac{1}{b-a}\right)^M$$

(b). maximized when

$\hat{a} = \min_m x^{(m)}$ $\hat{b} = \max_m x^{(m)}$.

$\therefore a = x^{(1)}$ $b = x^{(m)}$

P_2: $E(\bar{X}) = E\left(\frac{1}{M}\sum_{m=1}^{M} x^{(m)}\right)$

$$= \frac{1}{M}\sum_{m=1}^{M} E(x^{(m)})$$

$$= \frac{1}{M}(M\mu)$$

$$= \mu$$

$\therefore E(\bar{X}) = \mu$

$\therefore$ unbiased.