$$f(x_i; q) = q^{1-x_i}(1-q)^{x_i}$$

$$L(q) = \prod_{i=1}^{n} f(x_i; r) = q^{1-x_1}(1-q)^{x_1} \times q^{1-x_2}(1-q)^{x_2} \cdots \times q^{1-x_n}(1-q)^{x_n}$$

i)

$$L(q) = q^{n-\Sigma x_i}(1-q)^{\Sigma x_i} \rightarrow \text{likelihood}$$

$$\log L(q) = (n - \Sigma x_i)\log(q) + \Sigma x_i \log(1-q)$$

$$\frac{\partial \log L(q)}{\partial q} = \frac{(n-\Sigma x_i)}{q} - \frac{\Sigma x_i}{1-q} \overset{set}{\equiv} 0$$

$$q(1-q)\left(\frac{(n-\Sigma x_i)}{q} - \frac{\Sigma x_i}{1-q}\right) = (n-\Sigma x_i)(1-q) - (\Sigma x_i)q = 0$$

$$n - nq - \Sigma x_i + \cancel{\Sigma x_i q} - \cancel{\Sigma x_i q} = 0$$

$$n - nq - \Sigma x_i = 0$$

$$\downarrow$$

$$n(1-q) - \Sigma x_i = 0$$

$$\Sigma x_i = n(1-q)$$

ii)

maximum likelihood $\rightarrow$ $$\hat{q} = \frac{\sum_{i=1}^{n} X_i}{n}$$

iii)

$$\hookrightarrow \hat{q} = 1 - \frac{\#\text{ of } 1}{n} = 1 - \frac{17}{30} = 0.433$$

$\#17$

the MLE gives us 0.433 of the students are not interested in buying tickets

iv) The MLE of the population distribution based on the sample data = 0.433 (from eqn iii) — (a)

The q value obtained from our sample data — (b)

$$= \frac{13}{30} = 0.433$$

$\therefore$ Hence, from (a) and (b), we see that $a = b$.

$\therefore$ the MLE estimate is unbiased