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1. Likelihood Func$^n$:

let $\theta_1 = \mu$ $\theta_2 = \sigma^2$

$$L(\theta_1 \theta_2 \mid x_1, \ldots x_n) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(x_1-\mu)^2}{2\sigma^2}} \times \ldots$$

$$\times \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(x_n-\mu^2)}{2\sigma^2}}$$

Take log on both sides

$$\ln[L(\theta_1 \theta_2 \mid x_1 \ldots x_n)] = \ln\left(\frac{1}{\sqrt{2\pi\sigma^2}} e^{-(x_1-\mu)^2/2\sigma^2} \times \ldots \ldots \times \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(x_n-\mu)^2}{2\sigma^2}}\right)$$

$$= \ln\left(\frac{1}{\sqrt{2\pi\sigma^2}} e^{-(x_1-\mu)^2/2\sigma^2}\right) + \ldots + \ln\left(\frac{1}{\sqrt{2\pi\sigma^2}} e^{-(x_n-\mu)^2/2\sigma^2}\right)$$

$$= \frac{-1}{2} \ln(2\pi) - \ln(\sigma) - \frac{(x_1-\mu)^2}{2\sigma^2} - \ldots \frac{-1}{2} \ln(2\pi) - \ln(\sigma) - \frac{(x_n-\mu)^2}{2\sigma^2}$$

$$\ln[L(\theta_1 \theta \mid x_1 \ldots x_n)] = \frac{-n}{2} \ln(2\pi) - n\ln(\sigma) - \frac{(x_1-\mu)^2}{2\sigma^2} - \ldots - \frac{(x_n-\mu)^2}{2\sigma^2}$$

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$$\frac{\partial}{\partial \mu} \ln [L(\theta_1, \theta_2 \mid x_1 \dots x_n)] = 0 - 0 + \frac{(x_1 - \mu)}{\sigma^2} + \dots$$

$$\dots + \frac{(x_n - \mu)}{\sigma^2}$$

$$= \frac{1}{\sigma^2} [(x_1 + \dots + x_n) - n\mu] \quad \dots (1)$$

$$\frac{\partial}{\partial \sigma} \ln [L(\theta_1, \theta_2 \mid x_1 \dots x_n)] = 0 - \frac{n}{\sigma} + \frac{1}{\sigma^3} [$$

$$(x_1 - \mu)^2 + \dots + (x_n - \mu)^2 ] \quad \dots (2)$$

$$\frac{\partial}{\partial \mu} \ln [L(\theta_1, \theta_2 \mid x_1 \dots x_n)] = 0$$

$$x_1 + x_2 + \dots + x_n = n\mu$$

$$\theta_1 / \mu = \frac{x_1 + x_2 + \dots + x_n}{n}$$

$$\frac{\partial}{\partial \sigma} \ln [L(\theta_1, \theta_2 \mid x_1, \dots x_n)] = 0$$

$$\sigma^2 n = (x_1 - \mu)^2 + \dots + (x_n - \mu)^2$$

$$\theta_2 / \sigma^2 = \frac{(x_1 - \mu)^2 + \dots + (x_n - \mu)^2}{n}$$

$$\sigma = \sqrt{\frac{(x_1 - \mu)^2 + \dots + (x_n - \mu)^2}{n}}$$

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2. Likelihood Function:

$$L(\theta \mid n_1 \ldots n_n) = \prod_{i=1}^{n} \binom{m}{n_i} \theta^{n_i} (1-\theta)^{m-n_i}$$

$$\ln [L(\theta \mid n_1 \ldots n_n)] = \sum_{i=1}^{n} \left(\log \binom{m}{n_i} + n_i \log \theta + (m-n_i) \log (1-\theta)\right)$$

$$\frac{\partial}{\partial \theta} [\ln [L(\theta \mid n_1 \ldots n_n)]] = 0$$

$$\sum_{i=1}^{n} \frac{n_i}{\theta} - \frac{\sum_{i=1}^{n} (m-n_i)}{1-\theta} = 0$$

$$\frac{1-\theta}{\theta} = \frac{nm - \Sigma n_i}{\Sigma n_i}$$

$$\frac{1}{\theta} = \frac{nm}{\Sigma n_i}$$

$$\boxed{\theta = \frac{\Sigma n_i}{nm}}$$