

## O2P1Chkpt

O2-10 Checkpoint:

We know  $\Rightarrow$

$$\ln L(\alpha, \beta, \sigma^2 | y, x) = -\frac{n}{2} (\ln 2\pi + \ln \sigma^2) - \frac{1}{2\sigma^2} \sum_{i=1}^n (y_i - (\alpha + \beta x_i))^2$$

We also know  $\hat{y}_i = \alpha + \beta x_i$

$$\Rightarrow \ln L = -\frac{n}{2} (\ln 2\pi + \ln \sigma^2) - \frac{1}{2\sigma^2} \sum_{i=1}^n (y_i - \hat{y}_i)^2$$
$$\frac{\partial}{\partial \sigma^2} \ln L = 0 = -\frac{n}{2} \left( \frac{1}{\sigma^2} \right) + \frac{1}{2\sigma^4} \sum_{i=1}^n (y_i - \hat{y}_i)^2$$
$$\frac{\partial}{\partial \sigma^2} \ln L = 0 \Rightarrow -\frac{1}{2\sigma^2} \left( +n - \frac{1}{\sigma^2} \sum_{i=1}^n (y_i - \hat{y}_i)^2 \right)$$
$$n - \frac{1}{\sigma^2} \sum_{i=1}^n (y_i - \hat{y}_i)^2 = 0$$
$$= n = \frac{1}{\sigma^2} \sum_{i=1}^n (y_i - \hat{y}_i)^2 \quad \parallel \Rightarrow \boxed{\sigma_{MLE}^2 = \frac{1}{n} \sum_{i=1}^n (y_i - \hat{y}_i)^2}$$

Figure 1: O2-10

P1-10 Checkpoint:

```
q = qt(0.90 + (1-0.9)/2, 99)
u = 299852.4 + (q*79.01055/10)
l = 299852.4 - (q*79.01055/10)
cat("The confidence interval for 90%:", "(", u, ",", l, ")\n")
```

```
## The confidence interval for 90%: ( 299865.5 , 299839.3 )
```

```
q = qt(0.98 + (1-0.98)/2, 99)
u = 299852.4 + (q*79.01055/10)
l = 299852.4 - (q*79.01055/10)
cat("The confidence interval for 98%:", "(", u, ",", l, ")\n")
```

```
## The confidence interval for 98%: ( 299871.1 , 299833.7 )
```