3.1

a.b.

$H_0: \beta_2 = 0$ vs. $H_1: \beta_2 > 0$

$\varphi = \dfrac{\beta_2 - b_2}{SE(b_2)} \sim t_{0.05}(n-2)$ $t_{0.05}(62) \doteqdot 1.645$

$\varphi^* = \dfrac{0.01309}{0.00215} = 6.0884 > 1.645$

拒絕虛無假設,有證據支持$\beta_2 > 0$

c.

shift to right

d.

$t_{0.01}(62) \doteqdot 1.645$ if $\varphi^* > 1.645 \Rightarrow$ reject the null hypothesis

if $\varphi^* < 1.645$, do not reject the null hypothesis

e.

$H_0: \beta_2 = 0$ vs. $H_1: \beta_2 > 0$ $\varphi = \dfrac{\beta_2 - b_2}{SE(b_2)} \sim t_{0.01}(n-2)$

$t_{0.01}(62) \doteqdot 1.645$ $\varphi^* = \dfrac{0.01309}{0.00215} = 6.0884 > 1.645$

reject the null hypothesis. There is enough evidence that $\beta_2 > 0$. Economic conclusion: when the GDP increase 1 billion, we expect that the number of medals won will increase 0.01309

3.7

a.

$t^* = \frac{(a)}{2.672} = 4.31 \Rightarrow (a) = 11.5163$

b.

$\because$ $1.029 > 0 \Rightarrow$ relationship is increasing, and also increase in a constant rate.

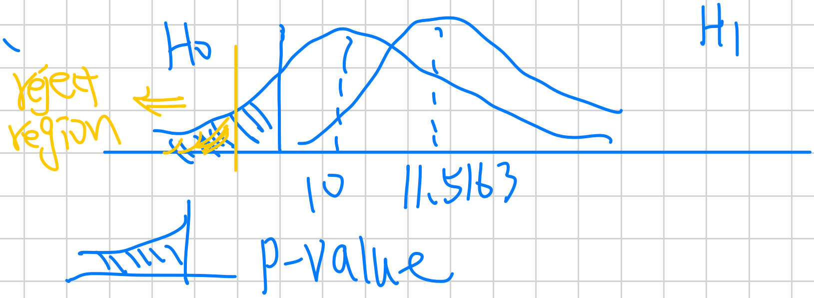
c.

$t^* = \frac{1.029}{(c)} = 10.75 \Rightarrow (c) = 0.0957$

d.

t-statistic value of intercept $= \frac{10}{2.672} = 3.7425$

e.



f.

$\widehat{income} = \beta_1 + \beta_2 BACHELOR$

confidence interval: $[1.029 \pm t_{0.005}(49) \times 0.0957]$

$t_{0.005}(49) = 2.576$ $\quad$ 0.2465

$\Rightarrow C.I = [1.029 \pm \overset{''}{2.576 \times 0.0957}]$

$= [0.7826, 1.2755]$

In repeated sampling, about 99% intervals constructed this way will contain the true value of the parameter β_2

g.

$H_0: \beta_2 = 1$ vs. $H_1: \beta_2 \neq 1$ $\quad t = \frac{b_2 - 1}{SE(b_2)} \sim t(49)$

$t_{0.025}(49) = 1.96$ $\quad t^* = \frac{1.029 - 1}{0.0957} = 0.303$

Do not reject the null hypothesis. There is no enough evidence to show that $\beta_2 \neq 1$

3.17

a.

$H_0: \beta_2 = 1.8$ vs. $H_1: \beta_2 > 1.8$ $\quad \varphi = \dfrac{b_2 - 1.8}{SE(b_2)} \sim t(986-2)$

$t_{0.05}(984) \cong z_{0.05} = 1.645$ $\quad \varphi^* = \dfrac{2.46 - 1.8}{0.16} = 4.125 > 1.645$

reject the null hypothesis. There is enough evidence to prove the $\beta_2 > 1.8$

b.

令 $\hat{y}_1 = -4.88 + 1.8 EDUC$

$\qquad\quad (3.29) \quad (0.24)$

$t_{0.025}(214-2) \cong z_{0.025} = 1.96$

95% C.I : $[(-4.88 + 1.8 \times 16) \pm 1.96 \times 0.833]$

$\Rightarrow [22.2873, 25.5527]$

$SE(\hat{y}_1) = \sqrt{3.29^2 + 0.24^2 \times 16^2 + 2 \times 16 \times (-0.761)}$

$= \sqrt{1.2177} = 1.1035$

c.

令 urban: $\hat{y}_2 = \widehat{WAGE} = -10.76 + 2.46EDUC$
$\qquad\qquad\qquad\qquad\qquad (2.27) \quad (0.16)$

$t_{0.025}(986-2) = t_{0.025}(984) \cong z_{0.025} = 1.96$

$SE(\hat{y}_2) = \sqrt{2.27^2 + 0.16^2 \times 16^2 + 2 \times 16 \times (-0.345)}$

$= 0.8164$

95% C.I: $[-10.76 + 2.46 \times 16 \pm 1.96 \times 0.8164]$

$\Rightarrow [26.9999, 30.2001]$

urban is narrower

d.

$H_0: \beta_1 \geq 4$ vs. $H_1: \beta_1 < 4$, $\varphi = \frac{\beta_1 - 4}{SE(\beta_1)} \sim t_{0.01}(214-2)$

$t_{0.01}(212) \cong z_{0.01} = 2.326$ $\quad \varphi^* = \frac{-4.88-4}{3.29} = -2.699$

拒絕虛無假設，有證據支持 $\beta_1 < 4$

3.19

a.

看起來兩者移動趨勢相同，且該公司擁有較高的訂房率

by R code

$$\widehat{MOTEL\_PCT} = 21.4 + 0.8646\, COMP\_PCT$$
$$(12.9069) \quad (0.2027)$$

95% C.I for β_2: $[0.4453, 1.2840]$

b.

by R code

90% C.I $[77.3822, 86.4673]$

c.

$H_0: \beta_2 \le 0$ vs. $H_1: \beta_2 > 0$ $\quad t = \dfrac{b_2 - 0}{SE(b_2)} \sim t(N-2)$

$\alpha = 0.01$, $t_{0.01}(23) = 2.5$ $\quad t^* = \dfrac{0.8646}{0.2027} = 4.2654$

拒絕虛無假設，有證據支持 $\beta_2 > 0$

d.

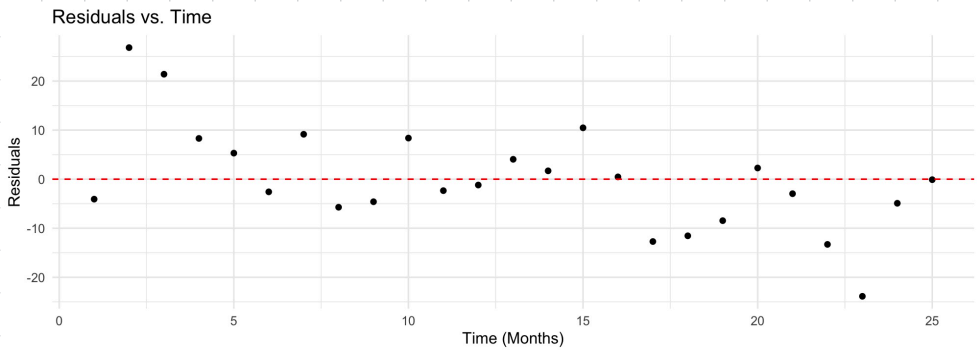
$H_0: \beta_2 = 1$ vs. $H_1: \beta_2 \neq 1$ $\quad t = \frac{b_2 - 1}{se(b_2)} \sim t(N-2)$

$t_{0.005}(23) = 2.807$ $\quad t^* = \frac{0.8646 - 1}{0.2027} = -0.6680$

無法拒絕虛無假設，無證據支持 $\beta_2 \neq 1$

當競爭對手的訂房率增加1單位，在無法拒絕虛無假設下，motel的訂房率會增加一單位

e.



by R code

1. 檢定異質變異數：p-value = 0.2042 > 0.05

⇒ 無異質變異數

2. 檢定自我相關：p-value = 0.0045 < 0.05

可誤差項有自我相關