CH3 HW0310 丁振朝

Q1

(a)

Null Hypothesis : There is no relationship between the number of medals won and GDP. This means the coefficient of GDP in the regression equation is zero:

H0:β2=0

Alternative Hypothesis : There is a positive relationship between the number of medals won and GDP. This means the coefficient of GDP is greater than zero:

H1:β2>0

(b)

進行 T 檢定可以得到 t = 0.01309 / 0.00215 = 6.088

under H0: t~t62

(c.)

If H0 is true, the test statistic follows a **t-distribution centered at 0**.

If H1 is true, the test statistic **shifts to the right** because the expected value of b2 is greater than zero

(d)

```
[1] "b2t值 6.46511627906977"
> print(paste("臨界值",t_crit))
[1] "臨界值 2.38801077482455"
> # 判斷是否拒絕 H0
> if (t_stat > t_crit) {
+   print("拒絕 H0：GDP 和獎牌數量有顯著正相關")
+ } else {
+   print("無法拒絕 H0：沒有足夠證據顯示 GDP 和獎牌數量有關聯")
+ }
[1] "拒絕 H0：GDP 和獎牌數量有顯著正相關"
```

(e)

Economic meaning: Countries with higher GDP tend to win more Olympic medals, possibly due to better sports funding, infrastructure, and training program

1% level of significance mean: The 1% significance level means that we are willing to accept a 1% probability of mistakenly rejecting the null hypothesis when it is actually true

Q7

(a)

Intercept = 4.31*2.672 = 11.51632

(b)

- The estimated relationship is increasing.
- It is a positive relationship.
- The increase is at a constant rate.

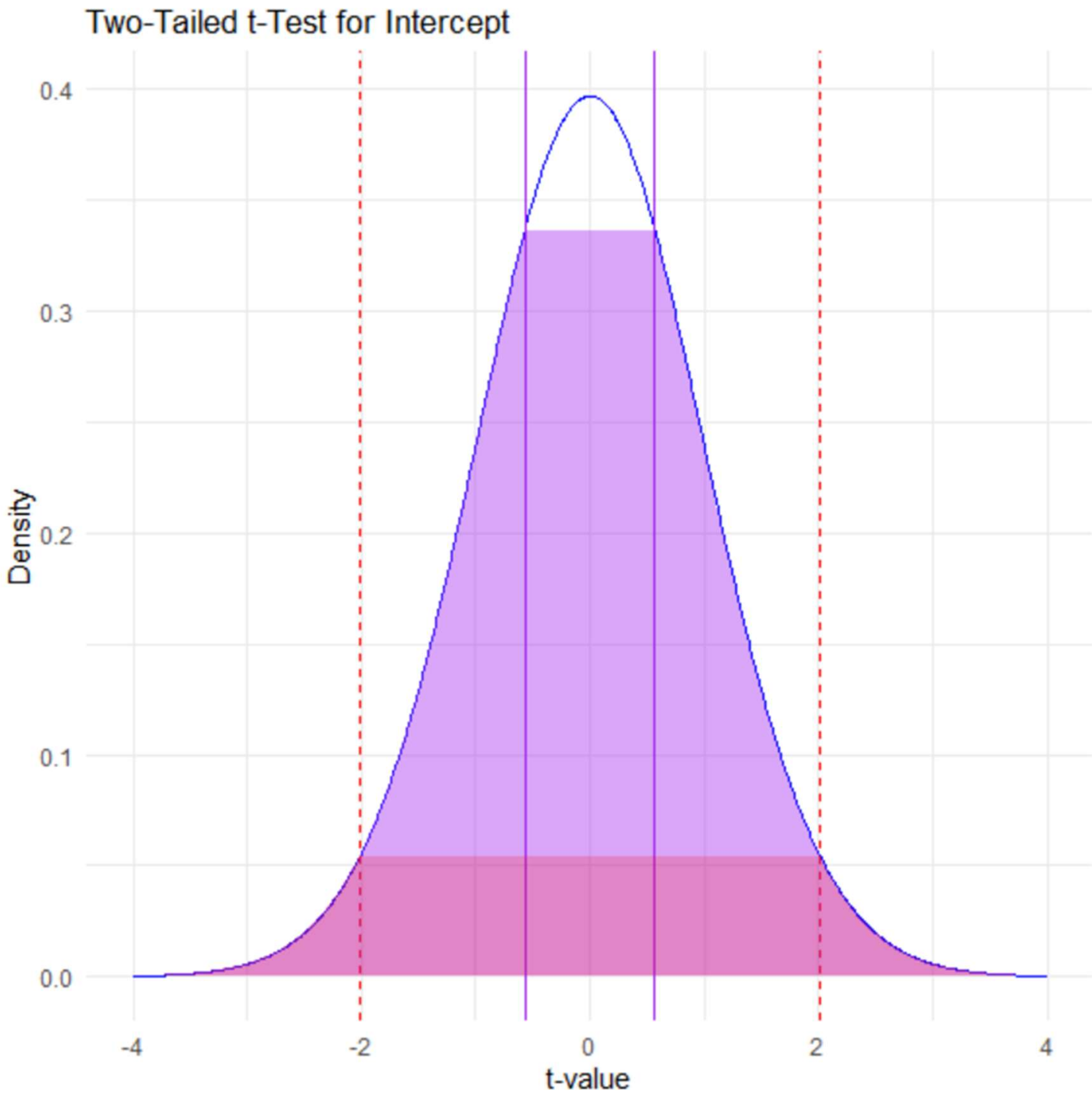
(c)

The standard error of the slope coefficient is **0.0958**. (1.029 / 10.75)

(d)

T = (11.51632 – 10) / 2.672 = 0.5675

(e)



(f)

```
> t_crit <- qt(0.005, df = 49, lower.tail = FALSE)
> print(t_crit)
[1] 2.679952
```

CI = 1.029±0.2567 = (0.7723, 1.2857)

(g)

H0 : beta 1 = 1

H1 : beta 1 不等於 1

T = (1.029-1)/0.0958 = 0.3028

```
> t_crit <- qt(0.025, df = 49, lower.tail = FALSE)
> print(t_crit)
[1] 2.009575
```

T 值<2.009575，不拒絕 H0

We **fail to reject H0**, there is **no significant evidence** to suggest that the true slope is different from 1.

In economic terms:

- This suggests that a **1 percentage point increase** in the **bachelor's degree rate** is associated with an approximately **$1,029 increase in income per capita**, which is **not statistically different** from the hypothesized increase of **$1,000 per capita** at the 5% level.

Q17

(a)

H0 = 1.8

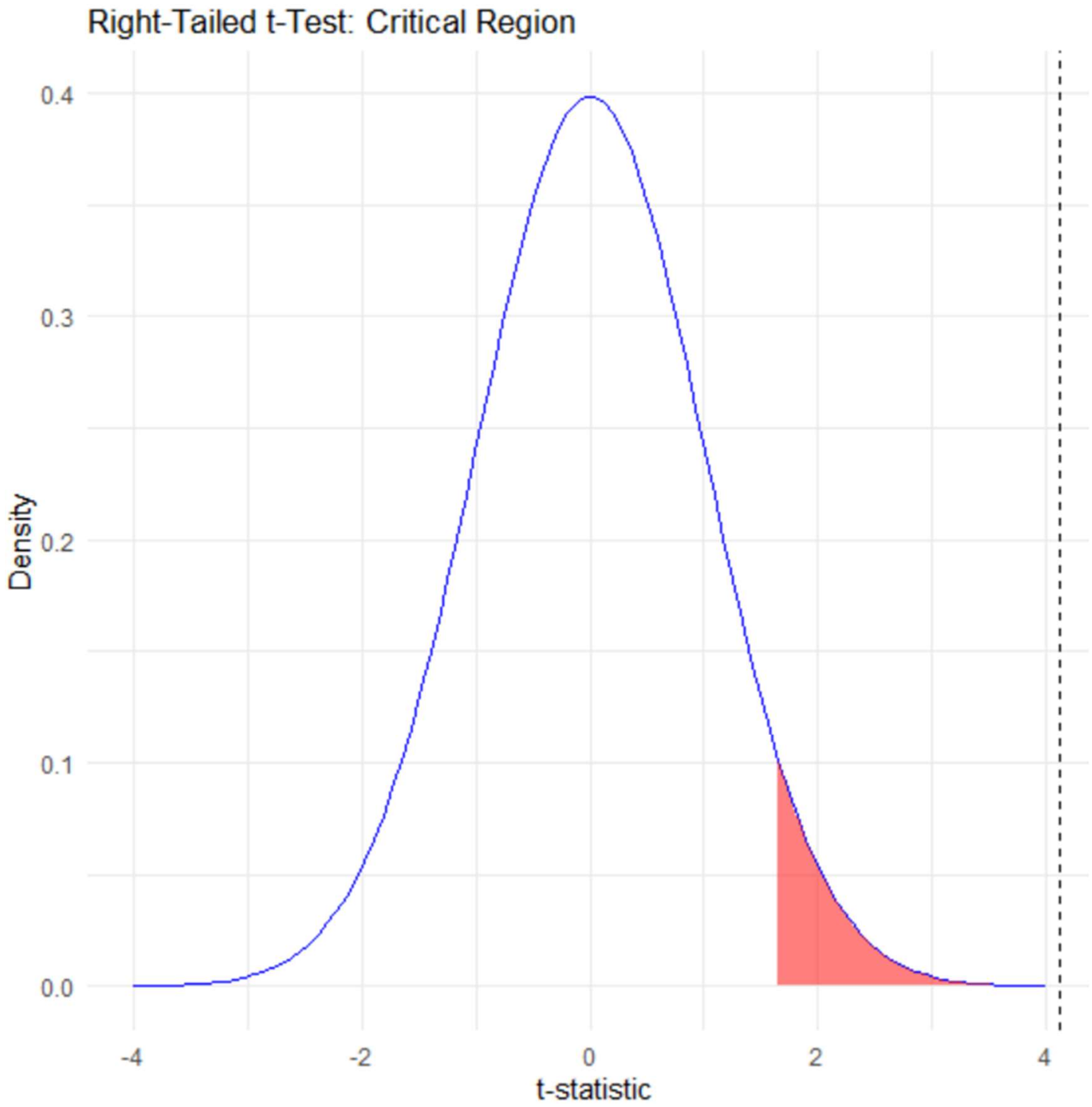
H1 >1.8

T 值 = (2.46-1.8)/ 0.16 = 4.125

臨界值 = 1.646404

```
> t_crit <- qt(0.95, df = 984)
> print(t_crit)
[1] 1.646404
```

拒絕 H0 (4.125>1.646404)



There is strong evidence that the true effect of schooling on wages in urban areas is greater than 1.80.

This means that an additional year of education increases hourly wages by more than \$1.80 in urban areas.

Education has a stronger impact on wages than the hypothesized level.

(b)

point estimate of expected wage is **\$23.92 (-4.88+28.8)**

SE(Wage) = $\sqrt{\mathbf{10.8241 + 14.7456 - 24.532}}$**=0.833**

```
> t_crit <- qt(0.975, df = 212)
> print(t_crit)
[1] 1.971217
```

95% confidence interval = (23.92−1.641,23.92+1.641) = (22.28,25.56)

(c)

point estimate of expected wage is **$28.60**

SE(Wage) = $\sqrt{5.1529 + 6.5536 - 11.04}$**=0.816**

```
> t_crit <- qt(0.975, df = 984)
> print(t_crit)
[1] 1.962378
```

95% confidence interval = (28.60−1.600,28.60+1.600) = (27.00,30.20)

The **urban interval is narrower** than the rural interval. **plausible** for the following reasons:

Larger Sample Size: The urban sample has **986 observations**, while the rural sample has only **214 observations**.

(d)

H0 : $\beta_1 \geq 4$

H1 : $\beta_1 < 4$

T 值 = (-4.88-4) /3.29 = -2.7

左尾檢定 =

```
> qt(0.01, df = 212)
[1] -2.344066
```

-2.7<2.344 所以拒絕 H0

解釋 : For someone with **zero years of education in rural areas**, the expected wage is **lower than $4** per hour.

Q19

(a)


Occupancy Rates Over Time
Occupancy Percentage
80
60
40
0
5
10
15
20
25
Time
Legend
Competitor
Motel

跑回歸:

```
lm(formula = wage ~ educ, data = cps5_small)

Residuals:
    Min      1Q  Median      3Q     Max 
-31.785  -8.381  -3.166   5.708 193.152 

Coefficients:
            Estimate Std. Error t value Pr(>|t|)    
(Intercept) -10.4000     1.9624    -5.3 1.38e-07 ***
educ          2.3968     0.1354    17.7  < 2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 13.55 on 1198 degrees of freedom
Multiple R-squared:  0.2073,	Adjusted R-squared:  0.2067 
F-statistic: 313.3 on 1 and 1198 DF,  p-value: < 2.2e-16
```

95% Confidence Interval for β2

```
                 2.5 %    97.5 %
(Intercept) -14.250083 -6.549835
educ          2.131116  2.662407
```

The plot helps us visually compare trends in motel and competitor occupancy.

The regression model quantifies the association.

The confidence interval tells us if we estimated β2 precisely

(b)

90% confidence interval (77.382, 86.467)

(c)

T 值 = 4.265

T 臨界值 = 2.499

拒絕 H0 顯著

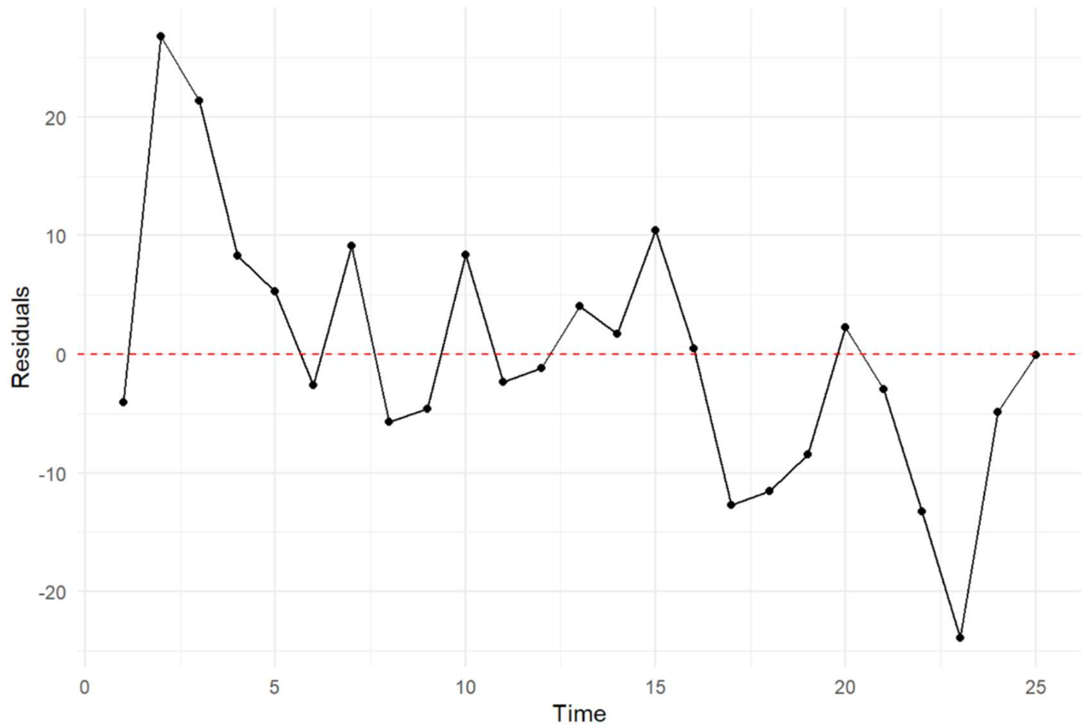
(d)

T 值 = -0.667

T 臨界值 = 2.807 or -2.807

不拒絕 H0

(e)



可以發現 time =17~23 期間 residual 比較偏離 0 ，表示模型恐存在低估的情形，原因可能來自 construction 的影響。