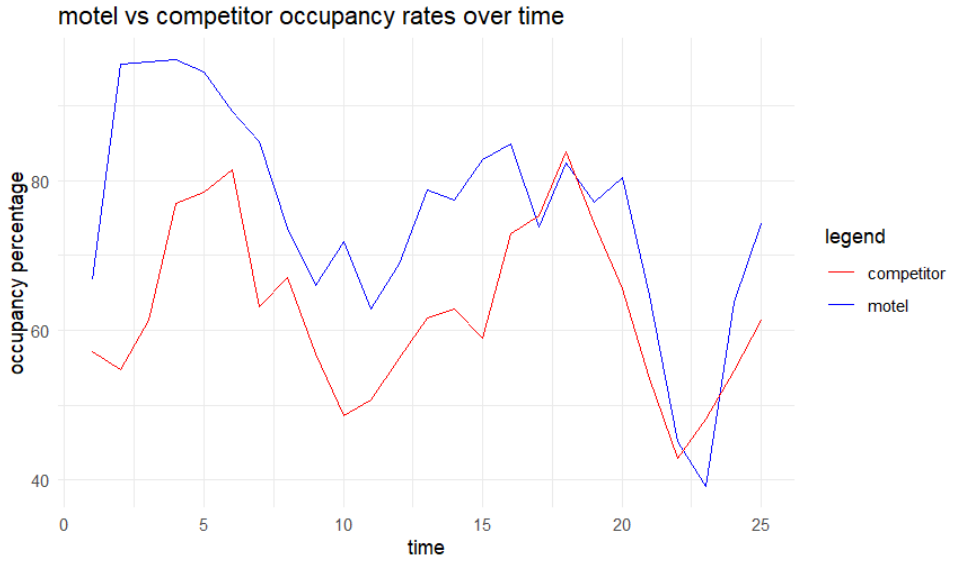
Q19.

(a)由上而下分別為與競爭者趨勢圖、線性回歸結果、95%信賴區間。可以看到業者與競爭者之間應該為高度相關，且線性回歸斜率為0.8646，可以佐證猜想。




```
Residuals:
    Min      1Q  Median      3Q     Max
-23.876  -4.909  -1.193   5.312  26.818

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  21.4000    12.9069   1.658 0.110889
comp_pct      0.8646     0.2027   4.265 0.000291 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 11.02 on 23 degrees of freedom
Multiple R-squared:  0.4417,    Adjusted R-squared:  0.4174
F-statistic: 18.19 on 1 and 23 DF,  p-value: 0.0002906
```

```
> confint(model, level = 0.95)
                2.5 %    97.5 %
(Intercept) -5.2998960 48.099873
comp_pct     0.4452978  1.283981
```

(b) 計算comp_pct=70時，motel_pct之90%信賴區間

```
       fit      lwr      upr
1 81.92474 77.38223 86.46725
```

(c )檢驗在99%信心水準下，斜率是否顯著大於0，結果顯示拒絕虛無假設，係數不小於等於0

```
> t_value <- coef(summary(model))[2, "t value"]
> p_value <- coef(summary(model))[2, "Pr(>|t|)"]
> alpha <- 0.01
> if (p_value < alpha) {
+   print("reject h0: there is a significant positive relationship.")
+ } else {
+   print("fail to reject h0: no significant relationship detected.")
+ }
[1] "reject h0: there is a significant positive relationship."
```

(d)無法拒絕虛無假設，即在99%信心水準下無法拒絕係數等於1。

```
> beta2 <- coef(model)[2]
> se_beta2 <- coef(summary(model))[2, "Std. Error"]
> t_test_stat <- (beta2 - 1) / se_beta2
> df <- nrow(motel_data) - 2
> t_critical <- qt(0.005, df, lower.tail = FALSE)
> if (abs(t_test_stat) > t_critical) {
+   print("reject h0: the slope significantly differs from 1.")
+ } else {
+   print("fail to reject h0: the slope is not significantly different from 1.")
+ }
[1] "fail to reject h0: the slope is not significantly different from 1."
```

(e)殘差在time前半段大多數為政，或些微負數，膽在後半段則完全相反。取出特定區兼做出對比在20047月~2005之間，殘差平均明顯小於0。