CH 8 Q06

(a) $n_{male} = 577$, $n_{female} = 423$

$df_{male} = 573$, $df_{female} = 419$, $\hat{\sigma}_M^2 = \frac{97161.9174}{573} = 169.567$

$H_0 : \sigma_M^2 = \sigma_F^2$

$H_1 : \sigma_M^2 \neq \sigma_F^2$

$$F = \frac{\hat{\sigma}_M^2}{\hat{\sigma}_F^2} \sim F_{573, 419}$$

$RR = \{F_0 \leq 0.8377 \text{ or } F_0 \geq 1.1968\}$

$$F_0 = \frac{169.567}{144.5766} = 1.1729$$

Do not reject H_0

(b)

$H_0 : \sigma_M^2 = \sigma_S^2$

$H_1 : \sigma_M^2 > \sigma_S^2$

$$F = \frac{\hat{\sigma}_M^2}{\hat{\sigma}_S^2} \sim F_{573, 393}$$

$RR = \{F_0 \geq 1.1647\}$

$$F_0 = \frac{169.3488}{142.3911} = 1.1889$$

Reject H_0

(c)

$H_0 : \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = 0$

$H_1 :$ not all $\alpha_i = 0$

$NR^2 = 59.03 > \chi^2_{0.95, 4} = 9.488$

Reject H_0 of the homoskedasticity.

(d)

$df_{White} = 20$ (本身、平方、交乘項)

$W = 78.82 > \chi^2_{0.05,20} = 31.41$

Reject H_0

(e)

EXPER、METRO、FEMALE 變異

EDUC 變寬

代表不同解釋變數的誤差型態不同，違反 homoskedasticity

(f)

在 (b) 的迴歸中加入 MARRIED 變數，且 White SE 為 1。

代表 MARRIED 對 WAGE 的影響不顯著。而在 (b) 小題中主要模定是變異數不同，而非 WAGE 不同，因此兩個結果是相容的。

CH8 Q16

(a)

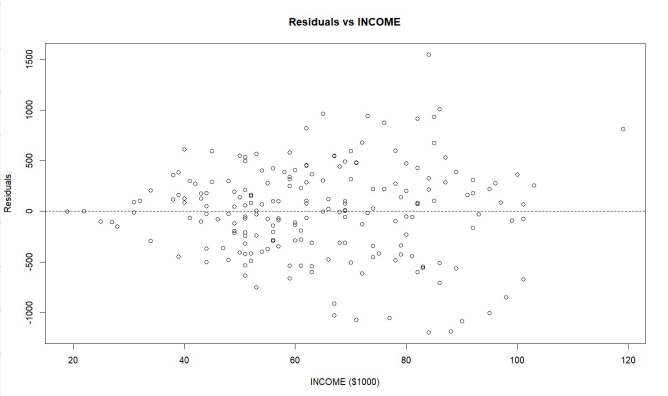
```
Call:
lm(formula = miles ~ income + age + kids, data = vacation)

Residuals:
     Min       1Q   Median       3Q      Max
-1198.14  -295.31    17.98   287.54  1549.41

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) -391.548    169.775  -2.306   0.0221 *
income        14.201      1.800   7.889 2.10e-13 ***
age           15.741      3.757   4.189 4.23e-05 ***
kids         -81.826     27.130  -3.016   0.0029 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 452.3 on 196 degrees of freedom
Multiple R-squared:  0.3406,    Adjusted R-squared:  0.3305
F-statistic: 33.75 on 3 and 196 DF,  p-value: < 2.2e-16
```

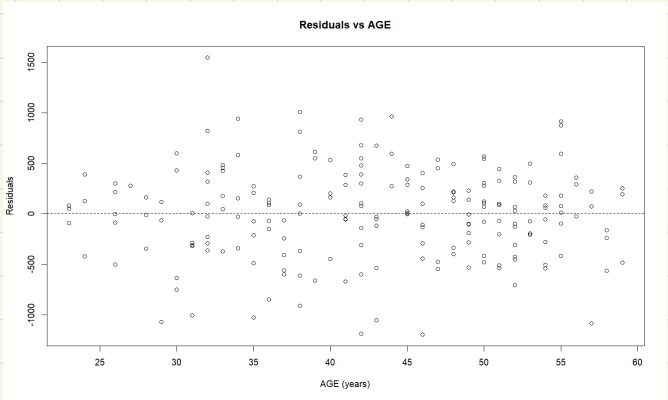
95% C.I. for Kids

$-81.826 \pm t_{0.025}(196) \times 27.13$

$= [-135.33, -28.323]$

(b)





Income 的殘差表現有增加的趨勢，而 Age 的殘差則沒有明顯的模式

(c)

$H_0: \sigma_1^2 = \sigma_2^2$

$H_1: \sigma_1^2 \neq \sigma_2^2$

$F = \frac{\sigma_1^2}{\sigma_2^2} \sim F_{86,86}$

```
        Goldfeld-Quandt test

data:  miles ~ income + age + kids
GQ = 3.1041, df1 = 86, df2 = 86, p-value = 1.64e-07
alternative hypothesis: variance increases from segment 1 to 2
```

(d)

Robust SE of kids = 29.154

95% C.I. for one more kid:

$= [-139.323, -24.33]$

信賴區間比 (a) 小題來得更寬

(e)

```
Generalized least squares fit by REML
  Model: miles ~ income + age + kids
  Data: vacation
       AIC      BIC    logLik
  2960.626 2977.017 -1475.313

Variance function:
 Structure: fixed weights
 Formula: ~income^2

Coefficients:
               Value Std.Error   t-value p-value
(Intercept) -424.9962 121.44414 -3.499520   6e-04
income        13.9473   1.48056  9.420293   0e+00
age           16.7175   3.02458  5.527212   0e+00
kids         -76.8063  21.84844 -3.515413   5e-04
```

GLS 95% C.I. of kids: $[-119.894, -33.718]$

CH8 Q18

(a)

將樣本分為 males 跟 females，分別估計 $\hat{\sigma}_M^2$ 和 $\hat{\sigma}_F^2$

$H_0: \sigma_M^2 = \sigma_F^2$

$H_1: \sigma_M^2 \neq \sigma_F^2$

$F = \frac{\hat{\sigma}_M^2}{\hat{\sigma}_F^2} \sim F_{n_1-9, n_2-9}$

$RR = \{F \leq 0.9453 \text{ or } F \geq 1.0581\}$

$F_0 = 1.0508$. Do not reject H_0

(b)

BP test using variables METRO, FEMALE, BLACK we get a test statistic = 23.557, the 1% critical value is $\chi^2(3) = 11.3449$. reject H_0 of homoskedasticity.

using all variables we get a test statistic = 69.42, the 1% critical value is $\chi^2(9) = 21.67$. reject H_0 of homoskedasticity.

(c)

White test statistic : 102.1691

Critical value at 5% (df = 13，去除 dummy 變數的平和交乘)

= 22.362

∴ Reject H_0 of homoskedasticity

(d)

	Conventional	Robust
(Intercept)	3.211489e-02	3.277743e-02
educ	1.758260e-03	1.904848e-03
exper	1.300342e-03	1.314237e-03
I(exper^2)	2.635448e-05	2.758278e-05
female	9.529136e-03	9.483417e-03
black	1.694240e-02	1.608548e-02
metro	1.230675e-02	1.157624e-02
south	1.356134e-02	1.389454e-02
midwest	1.410367e-02	1.371725e-02
west	1.440237e-02	1.454941e-02

觀察 SE 的變化 female、black、metro、midwest 的 C.I. 變窄、其他變寬

(e)

	FGLS	OLS_Robust
(Intercept)	3.159320e-02	3.277743e-02
educ	1.764615e-03	1.904848e-03
exper	1.297517e-03	1.314237e-03
I(exper^2)	2.678918e-05	2.758278e-05
female	9.480830e-03	9.483417e-03
black	1.699247e-02	1.608548e-02
metro	1.145945e-02	1.157624e-02
south	1.352230e-02	1.389454e-02
midwest	1.398389e-02	1.371725e-02
west	1.437651e-02	1.454941e-02

只有 black、midwest 的 C.I. 變寬、其餘都變窄

(f)

	FGLS_Robust	FGLS	OLS_Robust
(Intercept)	3.234310e-02	3.159320e-02	3.277743e-02
educ	1.891794e-03	1.764615e-03	1.904848e-03
exper	1.303951e-03	1.297517e-03	1.314237e-03
I(exper^2)	2.739429e-05	2.678918e-05	2.758278e-05
female	9.433258e-03	9.480830e-03	9.483417e-03
black	1.586064e-02	1.699247e-02	1.608548e-02
metro	1.155698e-02	1.145945e-02	1.157624e-02
south	1.382738e-02	1.352230e-02	1.389454e-02
midwest	1.370570e-02	1.398389e-02	1.371725e-02
west	1.450135e-02	1.437651e-02	1.454941e-02

使用 robust SE 進行 FGLS

(g) 因為先前已測試樣本中出現 heteroskedasticity，因此我會選擇 FGLS 的 estimates，因 SE 更小更精確