Part One: Backward Elimination

a. The best model for the IQ data set uses Test1, Test2 and Test4 as shown below

```
Step:  AIC=71.69
IQ ~ Test1 + Test2 + Test4

        Df Sum of Sq    RSS    AIC
<none>               1047.0 71.685
- Test2  1    406.25 1453.3 74.603
- Test1  1    415.39 1462.4 74.697
- Test4  1    484.13 1531.2 75.386

Call:
lm(formula = IQ ~ Test1 + Test2 + Test4, data = IQ)

Coefficients:
(Intercept)        Test1        Test2        Test4
     90.733       -1.965       -1.649        3.789
```

b. The adjusted R^2 value is 0.2158. This represents a modification that is supposed to take into account the number of terms in the model.

```
> fitbest = lm(IQ ~ Test1 + Test2 + Test4, data = IQ)
> summary(fitbest)

Call:
lm(formula = IQ ~ Test1 + Test2 + Test4, data = IQ)

Residuals:
     Min       1Q   Median       3Q      Max
-10.9184  -6.8179  -0.9142   4.3920  21.1950

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  90.7327    12.8272   7.073 2.06e-05 ***
Test1        -1.9650     0.9406  -2.089   0.0607 .
Test2        -1.6485     0.7980  -2.066   0.0632 .
Test4         3.7890     1.6801   2.255   0.0455 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 9.756 on 11 degrees of freedom
Multiple R-squared:  0.3839,    Adjusted R-squared:  0.2158
F-statistic: 2.284 on 3 and 11 DF,  p-value: 0.1356
```

c.

- All other things being equal, a higher score on the Test1 reduces IQ rating
- All other things being equal, an increase in Test2 scores reduces IQ rating
- All other things being equal, a higher score on the Test4 increases IQ rating
-

- **Part Two: ALL THREE**

Backward Elimination

```
Step:  AIC=213.38
Y ~ X2 + X4 + X6 + X10 + X11 + X12

       Df Sum of Sq     RSS     AIC
<none>                  608  213.38
- X11   1        11     618  213.63
- X2    1        14     622  214.33
- X10   1     23753   24360  683.83
- X12   1    247389  247996  980.85
- X4    1    444955  445563 1055.85
- X6    1   3278411 3279019 1311.33

Call:
lm(formula = Y ~ X2 + X4 + X6 + X10 + X11 + X12, data = stepwiseRegression)

Coefficients:
(Intercept)           X2           X4           X6          X10          X11          X12
 1410.27177     -0.06975      2.80806      5.98660    -11.97829     -0.13102    -25.98121
```

Forward Selection

```
Step:  AIC=213.38
Y ~ X6 + X4 + X12 + X10 + X2 + X11

       Df Sum of Sq    RSS    AIC
<none>              607.73 213.38
+ X7    1    6.0187 601.71 214.11
+ X5    1    4.7325 602.99 214.38
+ X3    1    3.2840 604.44 214.69
+ X9    1    2.6094 605.12 214.83
+ X8    1    2.1408 605.58 214.93
+ X1    1    0.6137 607.11 215.25

Call:
lm(formula = Y ~ X6 + X4 + X12 + X10 + X2 + X11, data = stepwiseRegression)

Coefficients:
(Intercept)           X6           X4          X12          X10           X2          X11
 1410.27177      5.98660      2.80806    -25.98121    -11.97829     -0.06975     -0.13102
```

Both

```
Step:  AIC=213.38
Y ~ X6 + X4 + X12 + X10 + X2 + X11

       Df Sum of Sq     RSS     AIC
<none>                  608  213.38
- X11   1        11     618  213.63
+ X7    1         6     602  214.11
- X2    1        14     622  214.33
+ X5    1         5     603  214.38
+ X3    1         3     604  214.69
+ X9    1         3     605  214.83
+ X8    1         2     606  214.93
+ X1    1         1     607  215.26
- X10   1     23753   24360  683.83
- X12   1    247389  247996  980.85
- X4    1    444955  445563 1055.85
- X6    1   3278411 3279019 1311.33

Call:
lm(formula = Y ~ X6 + X4 + X12 + X10 + X2 + X11, data = stepwiseRegression)

Coefficients:
(Intercept)           X6           X4          X12          X10           X2          X11
 1410.27177      5.98660      2.80806    -25.98121    -11.97829     -0.06975     -0.13102
```

a. All the final models from the 3 stepwise regression types are exactly the same.
b. An increase in predictor variables x4 and x6 cause an increase in Y, while a an increase in predictor variables x2, x10, x11 and x12 causes a decrease in response variable Y
c. These variables account for 99% of the variation in Y

```
> fitsome <- lm(formula = Y ~ X2 + X4 + X6 + X10 + X11 + X12, data = stepwiseRegression)
> summary(fitsome)

Call:
lm(formula = Y ~ X2 + X4 + X6 + X10 + X11 + X12, data = stepwiseRegression)

Residuals:
    Min      1Q  Median      3Q     Max
-5.3190 -1.7438 -0.0897  1.7094  5.3882

Coefficients:
             Estimate Std. Error  t value Pr(>|t|)
(Intercept)  1.410e+03  1.320e+01  106.815   <2e-16 ***
X2          -6.975e-02  4.158e-02   -1.677   0.0961 .
X4           2.808e+00  9.434e-03  297.644   <2e-16 ***
X6           5.987e+00  7.410e-03  807.924   <2e-16 ***
X10         -1.198e+01  1.742e-01  -68.769   <2e-16 ***
X11         -1.310e-01  8.950e-02   -1.464   0.1458
X12         -2.598e+01  1.171e-01 -221.937   <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 2.241 on 121 degrees of freedom
Multiple R-squared:  0.9999,    Adjusted R-squared:  0.9998
F-statistic: 1.385e+05 on 6 and 121 DF,  p-value: < 2.2e-16
```