HW3 self assessment

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October 3, 2018

(a) Test for the significance of each variable as it enters the model. For each of the three responses state the test: the null hypothesis in terms of the regression coefficient parameters, the value of the test statistic and the p-value of the statistic.

$n = 22$

$SS_{X_1} = 981.326$

$SS_{X_2|X_1} = 190.232$

$SS_{X_3|X_2,X_1} = 129.431$

$SS_{full} = SS_{X_1} + SS_{X_2|X_1} + SS_{X_3|X_2,X_1} = 981.326 + 190.232 + 129.431 = 1300.989$

$MSE_{X_1} = \frac{SS_{full}}{n} = 59.136$

$$F_{partial} = \frac{\frac{RSS_{Reduced} - RSS_{Full}}{\delta \# predictors(full - reduced)}}{\frac{RSS_{Full}}{n-k}}$$

1. when X_1 enters the model. null hypothesis is: $\beta_{X1} = 0$. The alternative hypothesis is $\beta_{X1} \neq 0$

$$F_1 = \frac{MSR_{X1}}{MSE_{full}} = \frac{\frac{SSreg_{X1}}{df_{X1}}}{\frac{SSE_{full}}{df(n-q-1)}} = \frac{\frac{981.326}{1}}{\frac{442.292}{18}} = 39.93711$$

when X_2 enters the model. null hypothesis is: $\beta_{X1} = \beta_{X2} = 0$. The alternative hypothesis is either $\beta_{X1} or/and \beta_{X1} \neq 0$

$$F_2 = \frac{MSR_{X2}}{MSE_{full}} = \frac{\frac{SSreg_{X2}}{df_{X2}}}{\frac{SSE_{full}}{df(n-q-1)}} = \frac{\frac{190.232}{1}}{\frac{442.292}{18}} = 7.74189$$

when X_3 enters the model. null hypothesis is: $\beta_{X1} = \beta_{X2} = \beta_{X3} = 0$. The alternative hypothesis is either $\beta_{X1} or/and \beta_{X1} or/and \beta_{X3} \neq 0$

$$F_3 = \frac{MSR_{X3}}{MSE_{full}} = \frac{\frac{SSreg_{X3}}{df_{X3}}}{\frac{SSE_{full}}{df(n-q-1)}} = \frac{\frac{129.431}{1}}{\frac{442.292}{18}} = 5.267466$$

```
pf(39.93711,1,18, lower.tail=F)  #P1
```

```
## [1] 5.896178e-06
```

```
pf(7.74189,1,18, lower.tail=F) #P2
```

```
## [1] 0.01229065
```

```
pf(5.267466,1,18, lower.tail=F)  #P3
```

```
## [1] 0.03396344
```

2. b. Test for the significance of adding both X_2 and X_3 to a model already containing X_1. State the test: the null hypothesis in terms of regression coefficient parameters, the value of the test statistic and the p-value of the statistic. Interpret at a significance level of 0.01.

Null hypothesis: $\beta_{X2} = \beta_{X3} = \beta_{X3} = 0$. The alternative hypothesis is either $\beta_{X2} or/and \beta_{X3} \neq 0$

$$F_{partial} = \frac{\frac{RSS_{full} - RSS_{reduced}}{\delta \# predictors(full - reduced)}}{\frac{RSS_{Full}}{n-k}} = \frac{\frac{RSS_{X1,X2,X3} - RSS_{X1}}{\delta \# predictors(X1,X2,X3-X1)}}{\frac{SSE_{Full}}{18}} = \frac{\frac{1300.989-981.326}{2}}{\frac{442.292}{18}} = 13.00936$$

```
pf(13.00936,2,18, lower.tail=F)  #P
```

```
## [1] 0.0003196803
```

c. In terms of the regression sums of squares (SSReg), identify the test that corresponds to comparing the two models:

Because the table above has a special order that does not fit the two models. It need to be in the order of X3, X1|X3, X2|X1,X3