Stat 482

Homework # 7 Solutions

$Y =$ patient satisfaction

$X_1 =$ age, $X_2 =$ illness severity, $X_3 =$ anxiety level

① $t_1^* = -5.315$, $t_2^* = -0.898$, $t_3^* = -1.897$

  $(p = .000)$ $(p = .374)$ $(p = .065)$

$\left[t_\ell^* \text{ is testing the } \underline{partial} \text{ effect of input } X_\ell, \text{ accounting for the effects of all other inputs.} \right]$

② $F^* = 30.05$, dfs $= (3, 42)$, $p = .000$, $R^2 = .6822$

$\left[F^* \text{ is testing the } \underline{joint} \text{ effect of all inputs } (X_1, \cdots, X_r). \right]$

③ $SSR(X_1) = 8275.4$, $SSR(X_2 | X_1) = 480.9$, $SSR(X_3 | X_1, X_2) = 364.2$

$SSR(X_1)$ measures the variation in patient satisfaction, explained by age.

$SSR(X_2 | X_1)$ measures variation explained by illness severity, beyond that explained by age ~~after accounting for the effect of age~~

$SSR(X_3 | X_1, X_2)$ measures variation explained by anxiety level, beyond that explained by age and illness severity.

④ (a) $F_{3|1}^* = 7.58 \ (p = .0086)$, (b) $F_{3|1,2}^* = 3.60 \ (p = .0647)$

(c) In part (a), we are testing for the effect of anxiety on patient satisfaction, after accounting for the effect of age.

In part (b), we are testing for the effect of anxiety after accounting for both age and illness severity effects.

HW 7 Computing

Data from Exercise 6.15

Our goal is to study the relationship between patient satisfaction (y) and patient's age (x1), severity of illness (x2), and anxiety level (x3).

:

```
hw7.data = read.table(
'http://users.stat.ufl.edu/~rrandles/sta4210/Rclassnotes/data/textdatasets/Ku
tnerData/Chapter%20%206%20Data%20Sets/CH06PR15.txt'
  )
colnames(hw7.data)=c("satisfaction","age","illness","anxiety")
str(hw7.data)

## 'data.frame':    46 obs. of  4 variables:
##  $ satisfaction: int  48 57 66 70 89 36 46 54 26 77 ...
##  $ age         : int  50 36 40 41 28 49 42 45 52 29 ...
##  $ illness     : int  51 46 48 44 43 54 50 48 62 50 ...
##  $ anxiety     : num  2.3 2.3 2.2 1.8 1.8 2.9 2.2 2.4 2.9 2.1 ...
```

```
m123 = lm(satisfaction ~ age + illness + anxiety, data = hw7.data)
```

```
summary(m123)

##
## Call:
## lm(formula = satisfaction ~ age + illness + anxiety, data = hw7.data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -18.3524  -6.4230   0.5196   8.3715  17.1601
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 158.4913    18.1259   8.744 5.26e-11 ***
## age          -1.1416     0.2148  -5.315 3.81e-06 ***
## illness      -0.4420     0.4920  -0.898   0.3741
## anxiety     -13.4702     7.0997  -1.897   0.0647 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 10.06 on 42 degrees of freedom
## Multiple R-squared:  0.6822, Adjusted R-squared:  0.6595
## F-statistic: 30.05 on 3 and 42 DF,  p-value: 1.542e-10
```

```
anova(m123)

## Analysis of Variance Table
##
## Response: satisfaction
##            Df Sum Sq Mean Sq F value    Pr(>F)
## age         1 8275.4  8275.4 81.8026 2.059e-11 ***
## illness     1  480.9   480.9  4.7539   0.03489 *
## anxiety     1  364.2   364.2  3.5997   0.06468 .
## Residuals  42 4248.8   101.2
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
m12 = lm(satisfaction ~ age + illness, data = hw7.data)
m13 = lm(satisfaction ~ age + anxiety, data = hw7.data)
m1 = lm(satisfaction ~ age, data = hw7.data)

anova(m1,m13)

## Analysis of Variance Table
##
## Model 1: satisfaction ~ age
## Model 2: satisfaction ~ age + anxiety
##   Res.Df    RSS Df Sum of Sq      F  Pr(>F)
## 1     44 5093.9
## 2     43 4330.5  1    763.42 7.5804 0.00861 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
anova(m12,m123)

## Analysis of Variance Table
##
## Model 1: satisfaction ~ age + illness
## Model 2: satisfaction ~ age + illness + anxiety
##   Res.Df    RSS Df Sum of Sq      F  Pr(>F)
## 1     43 4613.0
## 2     42 4248.8  1    364.16 3.5997 0.06468 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```