Stat5303

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Exercise 3.1

a.

```
library(cfcdae)
data("RatLiverWeight")
#View(RatLiverWeight)
m1 = RatLiverWeight[c(1:7),]
mu1 = mean(m1$weight)
m2 = RatLiverWeight[c(8:15),]
mu2 = mean(m2$weight)
m3 = RatLiverWeight[c(16:21),]
mu3 = mean(m3$weight)
m4 = RatLiverWeight[c(22:29),]
mu4 = mean(m4$weight)
mu = with(RatLiverWeight,mean(weight))
mu
```

```
## [1] 3.718276
```

```
(effect1 = mu1 - mu)
```

```
## [1] 0.02743842
```

```
(effect2 = mu2 - mu)
```

```
## [1] -0.1382759
```

```
(effect3 = mu3 - mu)
```

```
## [1] -0.1199425
```

```
(effect4 = mu4 - mu)
```

```
## [1] 0.2042241
```

b.

```
fit <- lm(weight~as.factor(diet),data=RatLiverWeight)
fit
```

```
##
## Call:
## lm(formula = weight ~ as.factor(diet), data = RatLiverWeight)
##
## Coefficients:
##      (Intercept)  as.factor(diet)1  as.factor(diet)2  as.factor(diet)3
##          3.71164           0.03408          -0.13164          -0.11330
```

```
anova(fit)
```

```
## Analysis of Variance Table
##
```

```
## Response: weight
##                 Df  Sum Sq  Mean Sq F value  Pr(>F)
## as.factor(diet)  3 0.57821 0.192736  4.6581 0.01016 *
## Residuals       25 1.03440 0.041376
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# I conlude that the P value is small, which means that I should reject the null hypothesis, this treat
```

Exercise 3.5

```
library(cfcdae)
data("Albizia")
fit1 = lm(angle~delay,data = Albizia)
fit2 = lm(angle~1,data = Albizia)
anova(fit1,fit2)
```

```
## Analysis of Variance Table
##
## Model 1: angle ~ delay
## Model 2: angle ~ 1
##   Res.Df    RSS Df Sum of Sq     F  Pr(>F)
## 1     12  697.6
## 2     14 1459.7 -2   -762.13 6.555 0.01191 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# The p value is tiny, we need to reject the null hypothesis, so I think the delay is important.
```

Problem 3.1

```
data("PacemakerPins")
#head(PacemakerPins)
#View(PacemakerPins)
fit3 = lm(strength~operator,data = PacemakerPins)
fit4 = lm(strength~1,data = PacemakerPins)
anova(fit3,fit4)
```

```
## Analysis of Variance Table
##
## Model 1: strength ~ operator
## Model 2: strength ~ 1
##   Res.Df    RSS Df Sum of Sq      F Pr(>F)
## 1     44 52.506
## 2     47 67.695 -3   -15.189 4.2427 0.0102 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# The p value is tiny, so the operators produce different mean shear strengths.
```

Problem 3.2

```
data("FruitFlyLifespan")
fit4 = lm(longevity~as.factor(companions),data = FruitFlyLifespan)
fit5 <- lm(longevity~1,data = FruitFlyLifespan)
anova(fit4,fit5)
```

```
## Analysis of Variance Table
##
## Model 1: longevity ~ as.factor(companions)
## Model 2: longevity ~ 1
##   Res.Df   RSS Df Sum of Sq      F    Pr(>F)
## 1    120 26314
## 2    124 38253 -4    -11939 13.612 3.516e-09 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# the p value is very tiny, so we should reject the null hypothesis and conclude that reproductive acti
# This experiment is done by CRD, which first randomly divided into differnent groups with sample sizes
```

Problem 3.7

```
data("ConcreteStrength")
fit7 = lm(strength~fiberPct,data = ConcreteStrength)
fit8 = lm(strength~1, data = ConcreteStrength)
anova(fit7,fit8)
```

```
## Analysis of Variance Table
##
## Model 1: strength ~ fiberPct
## Model 2: strength ~ 1
##   Res.Df    RSS Df Sum of Sq      F    Pr(>F)
## 1     10 1.2067
## 2     14 7.4693 -4   -6.2627 12.975 0.0005713 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# The p value is tiny, which means that we should reject the null hypothesis, and conclude that fiber c
```

Exercise 4.4

My construct is to construct to compare the average of two kinds of low moister to the average of two kinds of medium moisture. Set the constrast of (1/2,-1/2,0,1/2,-1/2,0). Let other parts 0 ensure there is no impact from other two parts of the units(high moisture and different kind of board).

Problem 4.2

```
data("FruitFlyLifespan")
#View(FruitFlyLifespan)
```

```r
none = FruitFlyLifespan[c(1:25),]
pre1 = FruitFlyLifespan[c(26:50),]
vir1 = FruitFlyLifespan[c(51:75),]
pre8 = FruitFlyLifespan[c(76:100),]
vir8 = FruitFlyLifespan[c(101:125),]
mu_none = mean(none$longevity)
mu_per1 = mean(pre1$longevity)
mu_vir1 = mean(vir1$longevity)
mu_per8 = mean(pre8$longevity)
mu_per8 = mean(pre8$longevity)
# The first test I construct is:
# Test if the new treatments impact the longevity differently from the male fruit flies that get none t
fit9 <- lm(longevity~companions,data = FruitFlyLifespan)
linear.contrast(fit9,companions,c(1,-1/4,-1/4, -1/4, -1/4))
```

```
##   estimates       se  t-value    p-value lower-ci upper-ci
## 1      7.65 3.311188 2.310349 0.02257688 1.094078 14.20592
```

```r
# The test is reasonable and let the none part be the control part.
# with significance level of 0.05, I should reject the null hypothesis, because the p value is less tha

# The second test I construct is to test if unreceptive or receptive does an impact to the longevity of
linear.contrast(fit9,companions,c(0,1/4,-1/4, 1/4, -1/4))
```

```
##   estimates       se   t-value     p-value  lower-ci  upper-ci
## 1     -4.15 1.480808 -2.802523 0.005913963 -7.081897 -1.218103
```

```r
# The p value is very small and I reject the null hypothesis, and conclude that there is difference bet
```

Problem 4.3

```r
data("PoliticalAds")
#View(PoliticalAds)
fit10 <- lm(response~condition, data = PoliticalAds)
#1
anova(fit10)
```

```
## Analysis of Variance Table
##
## Response: response
##            Df  Sum Sq Mean Sq F value    Pr(>F)
## condition   4  63.524  15.881  10.796 2.123e-07 ***
## Residuals 108 158.866   1.471
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
#2
linear.contrast(fit10,condition, c(-1/3, -1/3, -1/3, 1/2, 1/2))
```

```
##    estimates        se   t-value     p-value  lower-ci  upper-ci
## 1 -0.6188418 0.2304353 -2.685533 0.008384634 -1.075605 -0.162079
```

```r
#3
linear.contrast(fit10,condition, c(0, -1/2, 1/2, -1/2 ,1/2))
```

```
##   estimates        se  t-value      p-value  lower-ci upper-ci
## 1 0.9988498 0.2512163 3.976054 0.0001269597 0.5008954 1.496804
```

the p value of the anove is very small so we conclude that the media affects the perception. the p value of the second contrast is tiny and we reject the null hypothesis, and conclude that trancript dose change the response to the media. the p value of the third contrast is tiny, so we reject the null hypothesis, and conclude that the editorials affect preception positive reporting improve perception not so much as negative reporting decreases it

Problem 4.6

(2,-1,-1).(0,1,-1) = 0 + (-1) + 1 = 0 so these two contrasts are orthogonal to each other, so their SS partition the SS among treatment. The SS of treatment is 100, and the SS of contrast (2, -1, -1) is 80, so the SS of the (0,1,-1) is 100 - 80 = 20.