1

```
Analysis of Variance Table

Response: Response
          Df  Sum Sq  Mean Sq F value  Pr(>F)
Diet       3 0.52652 0.175506  4.4891 0.01185 *
Residuals 25 0.97740 0.039096
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Since p-value is smaller than 0.05, we conclude that there exists significant difference among the means corresponding to the four diets.

```
> fit.contrast(M1,varname="Diet",c(1,-1,0,0),conf=0.95)
                     Estimate Std. Error  t value  Pr(>|t|)    lower CI
Diet c=( 1 -1 0 0 ) 0.1407143  0.1023337 1.375053 0.1813139 -0.07004599
                     upper CI
Diet c=( 1 -1 0 0 ) 0.3514746
```

The 95% C.I. is [-0.07,0.35].

```
> fit.contrast(M1,varname="Diet",c(1/2,1/2,-1/2,-1/2),conf=0.95)
                                  Estimate Std. Error   t value  Pr(>|t|)
Diet c=( 0.5 0.5 -0.5 -0.5 ) -0.08505952 0.07395142 -1.150208 0.2609422
                                 lower CI   upper CI
Diet c=( 0.5 0.5 -0.5 -0.5 ) -0.2373653 0.06724627
```

The 95% C.I. is [-0.24,0.067].

Since p-value=0.26>0.05, we do not reject H0.

2

```
> summary(M2)

Call:
lm(formula = Diets$Response ~ D1 + D2 + D3)

Residuals:
    Min      1Q  Median      3Q     Max
-0.3857 -0.0950 -0.0525  0.1250  0.4443

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  3.71789    0.03698 100.549   <2e-16 ***
D1           0.02783    0.06450   0.431   0.6698
D2          -0.11289    0.06173  -1.829   0.0794 .
D3          -0.11955    0.06801  -1.758   0.0910 .
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.1977 on 25 degrees of freedom
Multiple R-squared:  0.3501,    Adjusted R-squared:  0.2721
F-statistic: 4.489 on 3 and 25 DF,  p-value: 0.01185
```

The estimate of alpha_4 is the inverse of the sum of the estimates for alpha_1, alpha_2 and alpha_3, which is 0.205.

The p-value for testing H_0: alpha_1=alpha_2=alpha_3=0 is 0.01185, which is exactly the same with that in part a, problem 1.

3

Source	df	SS	MS	F
feed	2	23.43	11.715	67.7312634
error	27	4.67	0.17296296	
total	29	28.1		

```
> pf(67.73,df1=2,df2=27,lower.tail=F)
[1] 3.008387e-11
```

Since p-value is much smaller than alpha, we should reject H0.