

We are interested in finding how the diets affect the coagulation rates of rabbits. Suppose that we have 3 different diets labelled as Diet A, Diet B and Diet C. The coagulation rate is the time in seconds that it takes for a cut to stop bleeding. We have 15 rabbits available for the experiment, so we will use 5 on each diet. The 15 rabbits are placed in a large compound until you are ready to begin the experiment, at which time they will be transferred to cages. The data are given below:

Table 2: Data for Question 4

Diet A	Diet B	Diet C
62	63	68
60	67	66
63	71	67
60	70	65
61	68	69

- (a) (3 points) Find the estimates of all the model parameters (treatment effects). Hints: Here, the total of all the data points $\sum \sum y_{i,j} = 980$.

- (b) (5 points) Fill in the following ANOVA table for the experiment. Show your calculations.

Table 3: ANOVA Table

Sources	df	Sum Sq	Mean Sq	F
Regression				
Error		55.60		
Total				

- (c) (2 points) Which critical F-value (qf is the R code) you should choose:
- $\text{qf}(.95, \text{df1}=2, \text{df2}=12) = 3.89$
 - $\text{qf}(.95, \text{df1}=2, \text{df2}=14) = 3.74$
 - $\text{qf}(.95, \text{df1}=3, \text{df2}=12) = 3.49$
 - $\text{qf}(.95, \text{df1}=3, \text{df2}=14) = 3.34$
- (d) (3 points) Does the experiment provide strong evidence that the differences are significant? Explain clearly. Make sure to write down your null and alternative hypothesis as well as the reason for your conclusion.

Multivariate linear regression:

In a study on the insurance redlining in Chicago, we have the following variables: 1, **involact** (response variable): new fair plan policies and renewals per 100 housing units; 2, **fire**: fires per 100 housing units; 3, **theft**: theft per 1000 population; 4, **income**: median family income in thousands of dollars.

Here is the incomplete R-output of the fitted linear model:

Call:

```
lm(formula = involact ~ theft + fire + income, data = chicago)
```

Residuals:

Min	1Q	Median	3Q	Max
-1.20577	-0.19381	-0.08709	0.20121	1.12676

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	1.051e+00	3.623e-01	2.900	0.00585 **
theft	-7.866e-03	3.271e-03	-2.405	0.02055 *
fire	4.582e-02	9.746e-03	4.701	2.68e-05 ***
income	-6.954e-05	2.777e-05	-2.504	0.01615 *

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.3975 on 43 degrees of freedom

Multiple R-squared: 0.6323, Adjusted R-squared: 0.6066

- (a) (6 points) Please complete following ANOVA table. Show your work on calculating MSE and F values.

Table 1: ANOVA Table				
Sources	df	Sum Sq	Mean Sq	F
Regression				
Error				
Total				

Table 1: ANOVA Table

Sources	df	Sum Sq	Mean Sq	F
Regression	3	11.683	3.894	24.65
Error	43	6.794	0.158	
Total	46	18.477		

$$MSE = 0.3975^2 = 0.158$$

$$SSE = MSE * df = 6.794$$

$$SST = \frac{SSE}{(1 - R^2)} = 6.794 / (1 - 0.6323) = 18.477$$

$$SSRegr = SST - SSE = 11.683$$

$$F = Msq(Regr) / Msq(Error) = 24.65$$