Problem 3 a)

```
> x1 <- c(1,2,3,3,4,5)
> x2 <- c(35,15,50,30,35,75)
> Y <- c(17,20,11,14,14,8)
> N = length(Y)
> X = cbind(rep(1,N),x1,x2)
> X
       x1 x2
[1,] 1  1 35
[2,] 1  2 15
[3,] 1  3 50
[4,] 1  3 30
[5,] 1  4 35
[6,] 1  5 75
> C = solve( t(X) %*% X)
> C
                            x1             x2
    1.157575758 -0.209090909 -0.0090909091
x1 -0.209090909  0.190909091 -0.0090909091
x2 -0.009090909 -0.009090909  0.0009090909
> betahat = C %*% t(X) %*% Y
> betahat
    [,1]
   22.70
x1 -0.90
x2 -0.15
```

b) & c)

```
> fit = lm(Y ~ x1+x2)
> summary(fit)

Call:
lm(formula = Y ~ x1 + x2)

Residuals:
    1     2     3     4     5     6
 0.45  1.35 -1.50 -1.50  0.15  1.05

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) 22.70000    1.71809  13.212 0.000937 ***
x1          -0.90000    0.69772  -1.290 0.287520
x2          -0.15000    0.04815  -3.115 0.052659 .
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 1.597 on 3 degrees of freedom
Multiple R-squared:  0.915,    Adjusted R-squared:  0.8583
F-statistic: 16.15 on 2 and 3 DF,  p-value: 0.02478
```

d)

```
> beta2hat = -0.15000
> beta2stderr = 0.04815
> t2 = beta2hat/beta2stderr; t2
 [1] -3.115265
> pt(t2,3,lower.tail=TRUE)
[1] 0.02633258
```

e)

```
> beta0hat = 22.70000
> beta0stderr = 1.71809
> t0 = (beta0hat-25)/beta0stderr; t0
[1] -1.338696
> pt(t0,3,lower.tail=TRUE)
[1] 0.1365377
```

f)

```
> beta1hat = -0.90000
> beta1stderr = 0.69772
> left = beta1hat - qt(0.975,3)*beta1stderr; left
[1] -3.120456
> right = beta1hat + qt(0.975,3)*beta1stderr; right
[1] 1.320456
```

g)

```
> predict.lm(fit,data.frame(x1=5,x2=60),interval=c("prediction"),level=0.9)
  fit      lwr      upr
1 9.2 4.496216 13.90378
```

h)

```
> SYY = sum((Y-mean(Y))^2)
> RSS = sum(fit$residuals^2)
> R2 = 1-RSS/SYY; R2
[1] 0.915
```