Multiple Regression

1 a) Coefficient of x_2 = -0.021. The age at death will decrease by 0.021 years for every additional unit of cholestrol level.

b) $\begin{cases} H_0: \beta_1=\beta_2=\beta_3=0 \\ H_1: \text{ at least one } \beta_i \neq 0 \end{cases}$ Test statistics: $F=\dfrac{MSR}{MSE}$

Rejection region: $F > F_{.05,\,3,\,36} = 2.84$

ANOVA table:

df	SS	MS	F
3	939	313	3.49
36	3227	89.64	
39	4166		

Since $F=3.49 > F_{.05,\,3,\,36} = 2.84$

Reject H_0 and conclude that model is significant in predicting lenght of life.

c) $\begin{cases} H_0: \beta_1 = 0 \\ H_1: \beta_1 \neq 0 \end{cases}$ Test statistics: $t=\dfrac{\hat{\beta}_1}{S_{\hat{\beta}_1}} : t_{0.005,36}$

Rejection region: $|t| > t_{0.005,36} = 2.724$

$$t=\frac{1.79}{0.44}=4.068$$

Since t= 4.068 > 2.724, reject H_0 at 1% level of significance and conclude that average number of hours of exercise and age at death are linearly related.

d) $R^2=0.225$. That is, 22.5% of the variation in age at death is explained by x_1, x_2 and x_3.

e) $\hat{y} = 55.8 + 1.79\,(8) - 0.021\,(0.5) - 0.016\,(10) = 69.95$ years

f) x_1 = average hours of exercise per week because it has largest absolute value of t of 4.068.

2 a) $\hat{y}=10+2.1(1.5)+13.6(3)=\$53.95$

b) $R^2=\dfrac{90.400-43.912}{90.400}=0.5142.$ That is, 51.42% of the variation in store price is explained by variations in current dividents and rate of growth.

c) $\begin{cases} H_0: \ \beta_1=\beta_2=0 \\ H_1: \text{at least one } \beta_i \neq 0 \end{cases}$ Test Statistic: $F=\dfrac{MSR}{MSE}$: $F_{0.05,2,7}$

Rejection region: $F > F_{0.05,2,7} = 4.47$

$F=\dfrac{23244}{6273.143}=3.7$

Since $F=3.7 < F_{0.05,2,7} = 4.47$, do not reject H_0. The model is not significiant.

d) $2.1(2.25) = \$4.725$ increase

3 a) $15232.5+2178.4x_1+7.8x_2+2675.2x_3+1157.8x_4$

b) for each additional room (x_1), the value of the house will increase by \$ 2,178.4

c) DF for $\begin{cases} SSR & 4 \\ SSE & 25 \end{cases}$

d) $\begin{cases} H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0 \\ H_1: \text{At least one } \beta_j \neq 0 \end{cases}$ Test statistic: $F = \dfrac{MSR}{MSE} : F_{0.05;4,25}$

Rejection region: $F > F_{0.05;4,25} = 2.76$

$$F = \frac{51060.72}{8235.60} = 6.2$$

Since $F = 6.2 > F_{0.05;4,25} = 2.76$, reject H_0 and conclude that the model is significant at 5% level.

e) $\begin{cases} H_0: \beta_1 = 0 \\ H_1: \beta_1 \neq 0 \end{cases}$ Test statistics: $t = \dfrac{\hat{\beta}_1}{S_{\hat{\beta}_1}} : t_{0.025,25}$

Rejection region: $|t| > t_{0.025,25} = 2.060$

$$t = \frac{2178.4}{778.0} = 2.8$$

Since $t = 2.8 > t_{0.025,25} = 2.060$, reject H_0 at 5% level and conclude that β_1 significant.

The number of rooms (X_1) is an important predictor of value of a house (Y).

f) $R^2 = \dfrac{204,242.88}{410,132.88} = 0.49799.$

That is, 49.8% of the variation is the value of a house is explained by the 4 independent variables.

g) $\hat{y} = 15,232.5 + 2,178.4(9) + 7.8(7.500) + 2.675.2(2) + 1.157.8$

$= \$99,846.3$