Question 4

a. 1. Set up the hypotheses

Ho: $\beta_1 = 0$
Ha: $\beta_1 \neq 0$

2. Test Statistics $t = \frac{b_1}{s_{b1}}$
3. Rejection Region for test $\alpha = 0.05$
$|t| > t_{0.025, df=13} = 2.160$

4. Given $b_1 = -0.3466, \ \ s_{b1} = 0.0587 \ , t = \frac{-0.3466}{0.0587} = -59.0459659$

5. Since $t_{observed} = 59.046 > t_{critical} = 2.160$

Reject Ho, conclude at 5% level significance. There is sufficient evidence to conclude that average hourly rate contributes useful information for prediction of quit rates.

The model suggests a negative relationship between quit rates and wages.

b. Given the sums and sums of squares, the coefficient of determination (R^2) can be calculated as

$R^2 = \frac{SS_{yy} - SSE}{SS_{yy}} = \frac{11.324 - 3.0733}{11.324} = 0.728603$

About 72.86% of variation in quit rate is accounted for by average hourly wage rate.

c. $\hat{y} = quit\ rate = 4.8615 - 0.3466\ (9) = 1.7421$, for $x_p = 9$

$\bar{x} = \frac{129.5}{15}\ 8.60333$

$\frac{(x_p - \bar{x})^2}{SS_{xx}} = \frac{(x_p - \bar{x})^2}{\sum(x - \bar{x})^2} = \frac{(9 - 8.6333)^2}{68.6999} = 0.00229035$

The 95% Confidence Interval for mean quit rate
$1.7421 \pm s\ (t_{0.0025,13}) * \sqrt{\frac{1}{15} + 0.00229035}$
$1.7421 \pm (0.486)\ (2.160) * \sqrt{\frac{1}{15} + 0.00229035}$
$1.7421 \pm (0.486)(2.160) * \ 0.2626 = 1.7421 \pm 0.27578 = (1.4663\ ;\ 2.0179)$
The mean quit rate for given average hourly wage rate of \$ 9 is estimated to range between 1.4663 and 2.0179with a 95% confidence interval.

d. the 95% Prediction Interval

$1.7421 \pm s\ (t_{0.0025,13}) * \sqrt{1 + \frac{1}{15} + 0.00229035}$

$1.7421 \pm 0.486\ (2.160) * \ 1.033904$

1.7421 ± 1.08583

0.6564 to 2.82793

The predicted quit rate ranges from 0.6564 to 2.82793for a given averages hourly wage rate of $9 with a 95% confidence.

Question 5

a. 1. Set up the hypotheses

Ho: $\beta_1 = \beta_2 = \beta_3 = 0$
Ha: $At\ least\ one\ \beta_i \neq 0$

2. Test statistics: $F = \frac{MSR}{MSE}$

3. Rejection Region for test at $\alpha = 0.05$

$F_{obserrved} > F_{critical} = F_{0.05,\,3,\,16} = 3.24$

4. ANOVA table $F = \frac{5158.3/3}{1539.9/16} = 17.8654$

Since $F_{obserrved} = 17.8654 > F_{critical} = F_{0.05,\,3,\,16} = 3.24$

Reject Ho and conclude at 5% level of significance. There is sufficient evidence to conclude that he model is useful in predicting labour cost.

b. 1. Set up the hypotheses

Ho: $\beta_3 = 0$
Ha: $\beta_3 \neq 0$

2. Test Statistics $t = \frac{b_3}{s_{b3}}$
3. Rejection Region for test $\alpha = 0.05$
$|t| > t_{0.025,df=16} = 2.120$

4. Given $b_3 = -2.5874,\ \ s_{b3} = 0.6428\ \ t = \frac{-2.5874}{0.6428} = -4.0252$

5. Since $t_{observed} = 4.0252 > t_{critical} = 2.120$

Reject Ho, conclude at 5% level significance.

p-value = $2P(t_{16} > 4.0252)$/ (<0.0005)
p-value < 0.001

There is sufficient evidence to conclude that average shipping weight contributes useful information for prediction of labor.

The model suggests a negative relationship between shipping weight and labor.

c. $R^2 = \frac{SS_{yy} - SSE}{SS_{yy}} = \frac{6698.2-1539.9}{6698.2} = 0.770102$

About 77.01% of variation in labor hours is due to variations in values of the predictions and is accounted for by the model.

d. $\hat{y} = 131.92 + (2.726)(6) + (0.04722)(0.4) + (-2.5874)(20) = 96.54689$