**4.1**

#sort data in ascending order

sortdataFrame <- Ass2data[order(Ass2data$X1), ]

Y<-sortdataFrame$Y

X1<-sortdataFrame$X1

X2<-sortdataFrame$X2

names(sortdataFrame)

# MRL model y = B1\*X1+B2\*X2+e1

model1<-lm(Y~X1+X2)

# get a summary of the model

summary(model1)

Call:

lm(formula = Y ~ X1 + X2)

Residuals:

Min 1Q Median 3Q Max

-22.5390 -4.2515 0.5995 6.5995 14.9330

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) -0.9225 3.0997 -0.298 0.767

X1 15.0461 0.4900 30.706 <2e-16 \*\*\*

X2 0.7587 2.7799 0.273 0.786

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Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

**Residual standard error: 9.011 on 42 degrees of freedom**

Multiple R-squared: 0.9576, Adjusted R-squared: 0.9556

F-statistic: 473.9 on 2 and 42 DF, p-value: < 2.2e-16

# the estimated regression function.

b0<-(-0.9225)

b1<-15.0461

b2<-0.7587

**yhat<-b0+b1\*X1+b2\*X2**

**(Yhat = -0.9225+15.0461\*X1+0.7587\*X2)**

#Large (X2=0): If the number of coppiers serived increases by 1 unit then

#number of minutes spend on the phone increase 15.0461. Y = -0.9225 + 15.0461 #(X1)

#Small (X2=1): If the copier is a small copier time on a service call is

#will increase that time by .7587 in comparison to large coppiers. Y= -0.1638 #+ 15.0461 (X1)

**4.2**

#Estimate the effect of copier model X2 on mean service time µy with a 95%

#confidence interval.

confint(model1, level = .95)

2.5 % 97.5 %

(Intercept) -7.177891 5.332945

X1 14.057283 16.035004

X2 -4.851254 6.368698

**4.3**

#residuals of model1

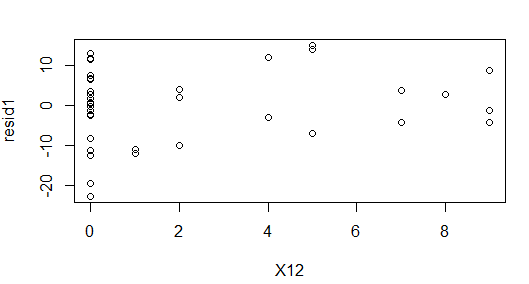
resid1<-resid(model1)

# X1 \*X2 = X12

X12<-X1\*X2

#Plot residual again X12

plot(X12,resid1)



Based on the residual plot with the interaction term and the original residual it appears that it would not be benefited for the model to add in an interaction term. Snice we have multiple residuals at single point(X12=0) therefore we lack evidence to conclude that the interaction term would be helpful in the model.

**4.4**

#4 Fit the regression model yi = β0 + β1xi1 + β2xi2 + β12xi1xi2 + ei

model2<-lm(Y~X1+X2+X12)

# get a summary of the model2

summary(model2)

Call:

lm(formula = Y ~ X1 + X2 + X12)

Residuals:

Min 1Q Median 3Q Max

-19.2072 -6.7887 -0.1708 7.1504 14.7441

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 2.8131 3.6468 0.771 0.4449

X1 14.3394 0.6146 23.333 <2e-16 \*\*\*

X2 -8.1412 5.5801 -1.459 0.1522

X12 1.7774 0.9746 **1.824** 0.0755 .

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Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 8.771 on 41 degrees of freedom

Multiple R-squared: 0.9608, Adjusted R-squared: 0.9579

F-statistic: 334.6 on 3 and 41 DF, p-value: < 2.2e-16

#provide the estimated regression function.

**Yhat2 = 2.8131 + 14.3394 (X1) -8.1412(X2) + 1.7774(X12)**

**4.5**

#T-value from Table Decision Rule

t <- qt(0.975, 41)

c(t)= **2.019541**

t-test of interaction term X1\*X2 (X12) is **1.824**

**t-test < T-Value (1.824<2.019) so we cannot reject null hypotheses**

**Hypotheses:**

H0 :β3 = 0;

HA :β3 ≠ 0;

P value of interaction term X1\*X2 (X12) is **0.0755 < 0.10 (**α = 10%**)** so interaction term cannot be dropped.

Interaction Term(X12):  If the number of Interaction Term increases by 1 unit then number of minutes spend increase by 1.7774. This concludes that we have a relationship between the response variable Y and the Interaction Team X12.

Yhat2 = 2.8131 + 14.3394 (X1) -8.1412(X2) + 1.7774(Interaction Term)

summary(model2)

Call:

lm(formula = Y ~ X1 + X2 + X12)

Residuals:

Min 1Q Median 3Q Max

-19.2072 -6.7887 -0.1708 7.1504 14.7441

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 2.8131 3.6468 0.771 0.4449

X1 **14.3394** 0.6146 23.333 <2e-16 \*\*\*

X2 **-8.1412** 5.5801 -1.459 0.1522

X12 **1.7774** 0.9746 1.824 0.0755 .

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Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 8.771 on 41 degrees of freedom

Multiple R-squared: 0.9608, Adjusted R-squared: 0.9579

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