R Notebook

Code

Problem 5

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```
x = c(300, 350, 400, 400, 450, 450, 480, 480, 530, 530,  580,  580,  620,  620,  670,  700)
y = c(5.8, 4.5, 5.9, 6.2, 6.0, 7.5, 6.1, 8.6, 8.9, 8.2, 14.2, 11.9, 11.1, 11.5, 14.5, 14.8)
x_trimmed = c(350, 400, 400, 450, 450, 480, 480, 530, 530,  580,  620,  620,  670,  700)
y_trimmed = c(4.5, 5.9, 6.2, 6.0, 7.5, 6.1, 8.6, 8.9, 8.2, 11.9, 11.1, 11.5, 14.5, 14.8)

plot(x, y, main="Problem 5a/b")
xylm = lm(y ~ x)
abline(xylm)
```

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```
xylm
```

```

Call:
lm(formula = y ~ x)

Coefficients:
(Intercept)            x
   -4.79841      0.02733
```

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```
anova(xylm)
```

```
Analysis of Variance Table

Response: y
          Df  Sum Sq Mean Sq F value    Pr(>F)
x          1 148.930 148.930  71.163 7.346e-07 ***
Residuals 14  29.299   2.093
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

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```
summary(xylm)
```

```
Call:
lm(formula = y ~ x)

Residuals:
    Min      1Q  Median      3Q     Max
-2.2205 -0.8520 -0.1173  0.5616  3.1464

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) -4.79841    1.68750  -2.844    0.013 *
x            0.02733    0.00324   8.436 7.35e-07 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 1.447 on 14 degrees of freedom
Multiple R-squared:  0.8356,    Adjusted R-squared:  0.8239
F-statistic: 71.16 on 1 and 14 DF,  p-value: 7.346e-07
```

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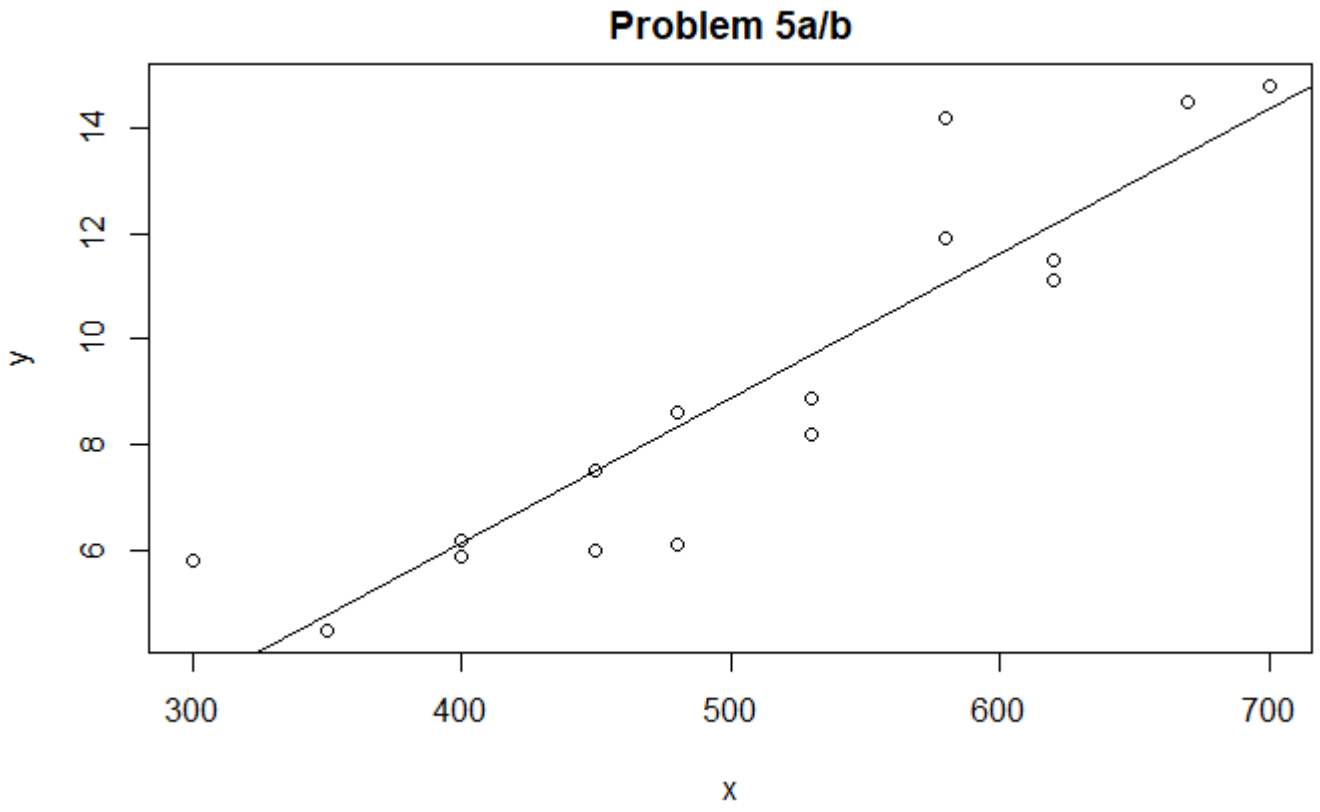
```
par(mfrow = c(2,2))
```



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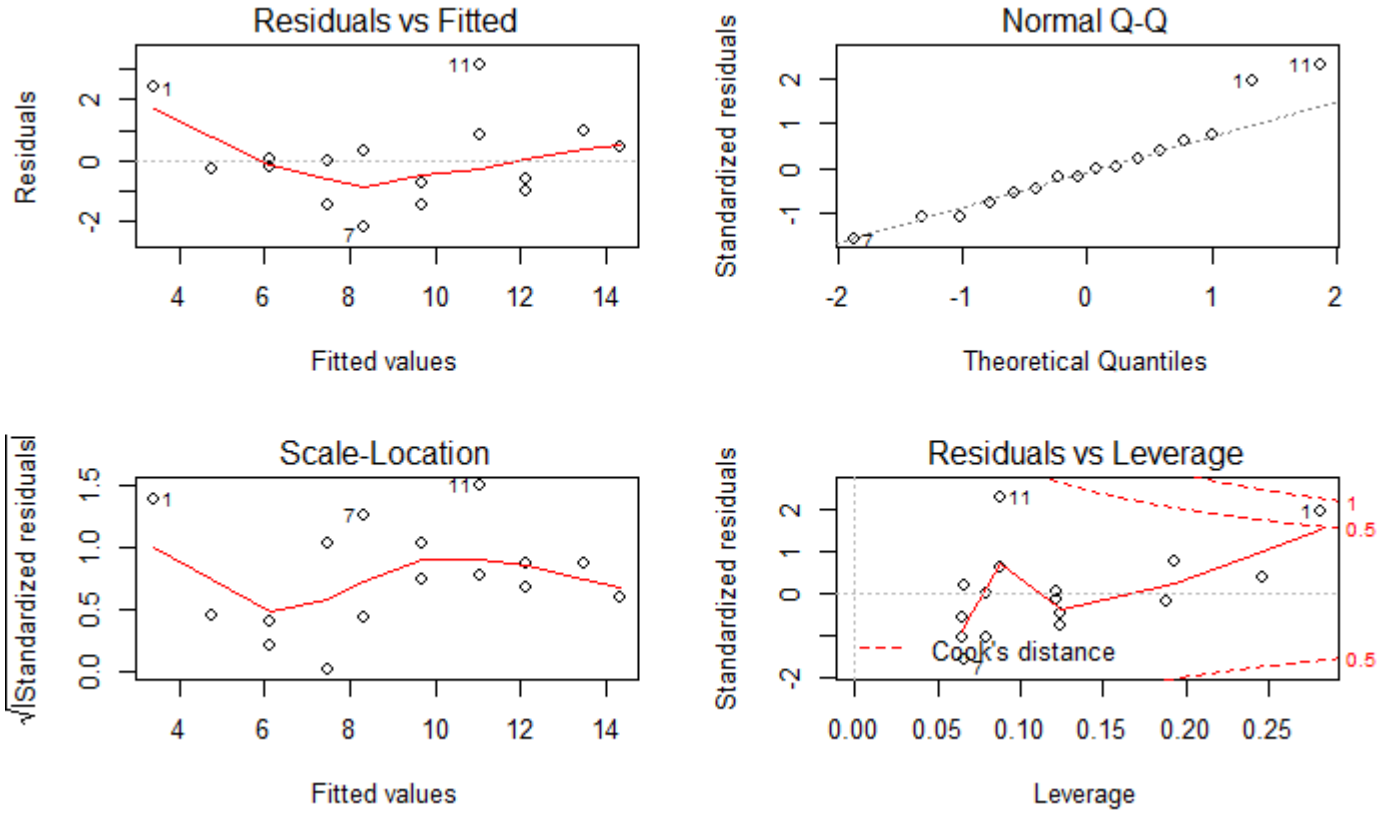
```
plot(xylm)
```



It appears that as x increases, so does y. The line of best fit found by simple linear regression seems to agree. Intercept = -4.79841 Slope = 0.02733 y = 0.02733x - 4.79841

Problem 6

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```
require(quantmod)
require(moments)
require(symmetry)
require(ICS)
sp500 = new.env()
getSymbols("^GSPC",from="2017-1-1", to="2020-9-2", env=sp500, src="yahoo")
GSPC = sp500$GSPC$GSPC.Adjusted
chartSeries(GSPC$GSPC.Adjusted, theme="white")
mean(GSPC)
sd(GSPC)
GSPC_skew = (sum((GSPC - mean(GSPC))^3)/nrow(GSPC))/((sum((GSPC - mean(GSPC))^2)/nrow(GSPC))^(3/
2))
GSPC_skew
GSPC_kurt = (sum((GSPC - mean(GSPC))^4)/nrow(GSPC))/((sum((GSPC - mean(GSPC))^2)/nrow(GSPC))^(2
))
GSPC_kurt
min(GSPC)
max(GSPC)
GSPC_density = density(GSPC)
plot(GSPC_density, main="Simple return density plot")
qqnorm(GSPC, main="Simple return Normal Q-Q Plot")
fBasics::normalTest(as.vector(GSPC), method="jb")

logGSPC = diff(log(GSPC$GSPC.Adjusted))[-1,]
mean(logGSPC)
sd(logGSPC)
logGSPC_skew = (sum((logGSPC - mean(logGSPC))^3)/nrow(logGSPC))/((sum((logGSPC - mean(logGSPC))^
2)/nrow(logGSPC))^(3/2))
logGSPC_skew
logGSPC_kurt = (sum((logGSPC - mean(logGSPC))^4)/nrow(logGSPC))/((sum((logGSPC - mean(logGSPC))^
2)/nrow(logGSPC))^(2))
logGSPC_kurt
min(logGSPC)
max(logGSPC)
t.test(as.vector(logGSPC), mu=0)
S = skewness(logGSPC)/sqrt(6/length(logGSPC))
2*pnorm(-abs(S))
K = kurtosis(logGSPC)/sqrt(24/length(logGSPC))
2*pnorm(-abs(K))
```

Problem 7

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```
getFX("USD/CNY", from="2020-4-01", to="2020-9-2")
```

```
[1] "USD/CNY"
```

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```
logUSDCNY = diff(log(USDCNY$USD.CNY))[-1,]
mean(logUSDCNY)
```

```
[1] -0.0002461043
```

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```
sd(logUSDCNY)
```

```
[1] 0.001378411
```

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```
logUSDCNY_skew = (sum((logUSDCNY - mean(logUSDCNY))^3)/nrow(logUSDCNY))/((sum((logUSDCNY - mean
(logUSDCNY))^2)/nrow(logUSDCNY))^(3/2))
logUSDCNY_skew
```

```
[1] -0.4605336
```

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```
logUSDCNY_kurt = (sum((logUSDCNY - mean(logUSDCNY))^4)/nrow(logUSDCNY))/((sum((logUSDCNY - mean
(logUSDCNY))^2)/nrow(logUSDCNY))^(2))
logUSDCNY_kurt
```

```
[1] 5.644422
```

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```
min(logUSDCNY)
```

```
[1] -0.004928916
```

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```
max(logUSDCNY)
```

```
[1] 0.004708191
```

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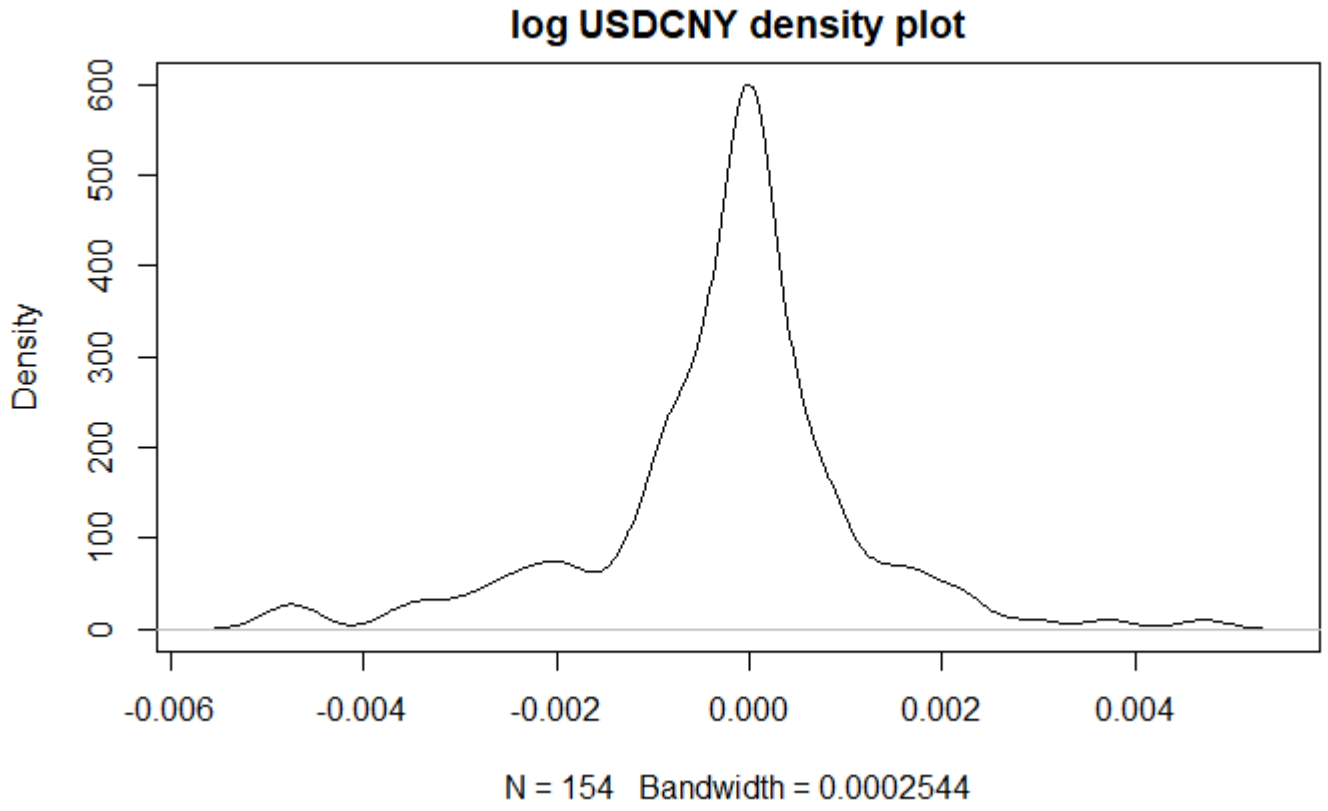
```
logUSDCNY_density = density(logUSDCNY)
plot(logUSDCNY_density, main="log USDCNY density plot")
```



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```
t.test(as.vector(logUSDCNY), mu=0)
```

```

    One Sample t-test

data:  as.vector(logUSDCNY)
t = -2.2156, df = 153, p-value = 0.02819
alternative hypothesis: true mean is not equal to 0
95 percent confidence interval:
 -4.655441e-04 -2.666455e-05
sample estimates:
    mean of x
-0.0002461043
```

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```
fBasics::normalTest(as.vector(logUSDCNY), method="jb")
```

```
Title:
 Jarque - Bera Normalality Test

Test Results:
  STATISTIC:
    X-squared: 50.3152
  P VALUE:
    Asymptotic p Value: 1.186e-11

Description:
 Sun Sep 20 19:11:28 2020 by user: rosha
```

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```
qqnorm(logUSDCNY, main="log USDCNY Normal Q-Q Plot")
```