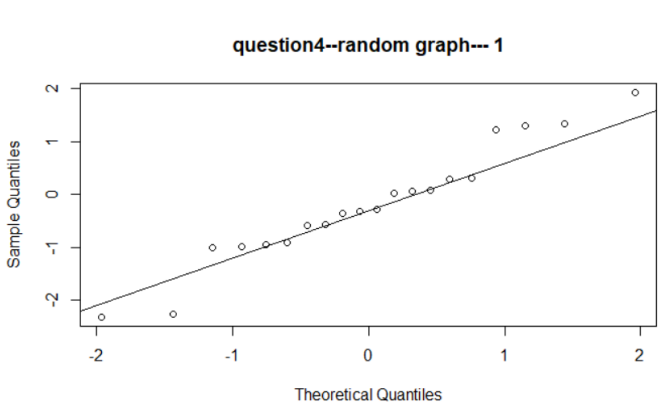

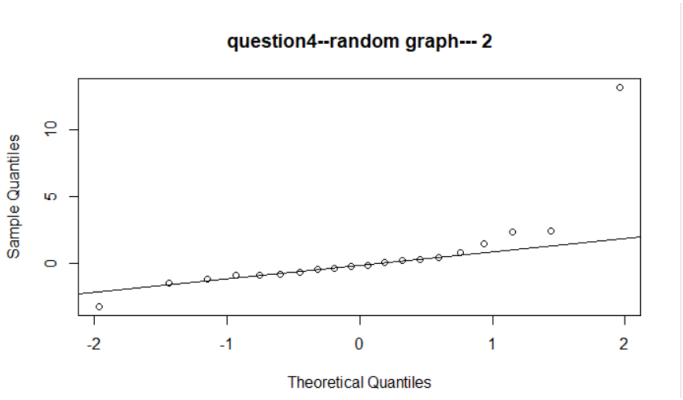

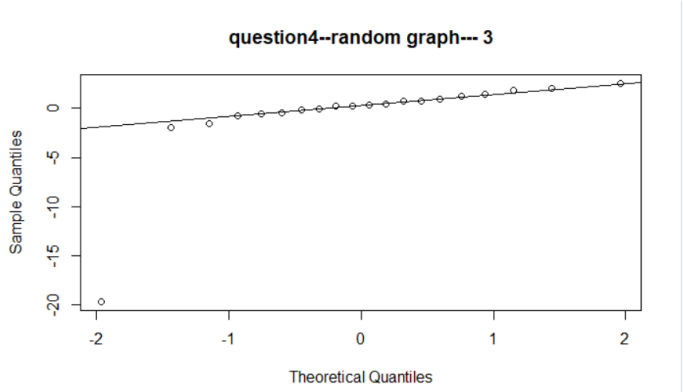

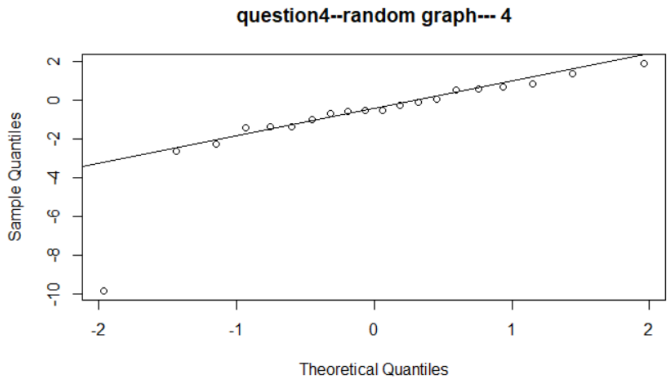

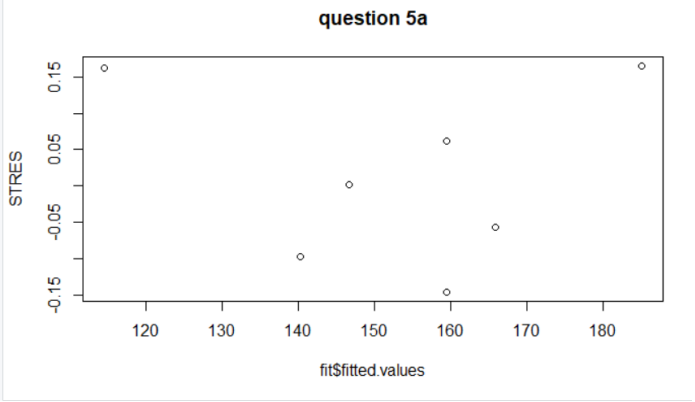

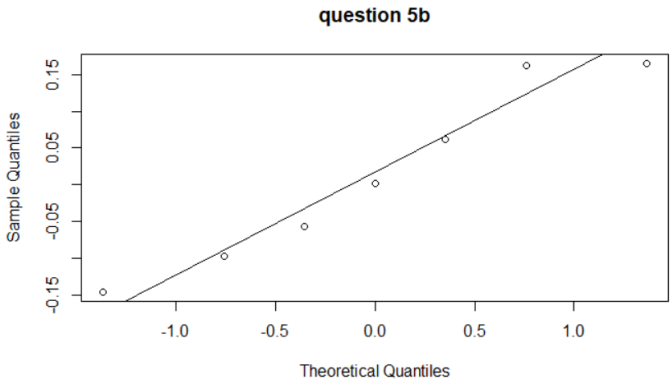

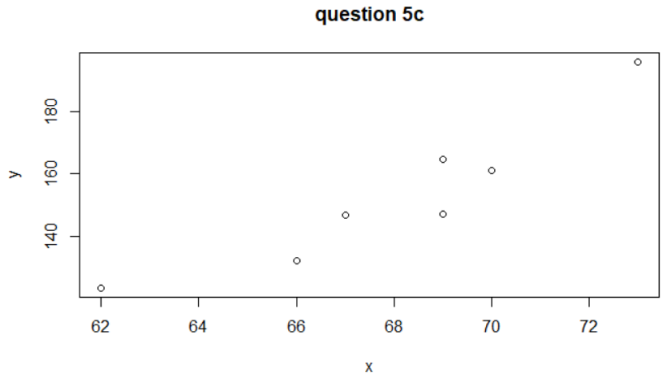

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First page : all the graphs

Second page: the source code

Third page : answers of each questions

****

```r
# VAN HOU HEI
# DB92728-3
# ASssignment 7
# Program for question 4 ,5
question4 <- function()
{
  SIZE = 20
  for(x in 1:4)
  {
    tempX = rt(SIZE , df=2)
    qqnorm(tempX , main=paste("question4--random graph---" , x))
    qqline(tempX)
  }
}
SDE <- function(x,meanX ,res) #duplicate name of residuals
{
   n= length(x)
   SYX = sum( res ^ 2) / (n-2)
   return ( sqrt( 1-1/n-((x-meanX)^2) / sum((x-meanX)^2) ) * SYX)
}
question5 <- function()
{
   x= c( 62 ,66, 69, 67, 70, 69, 73)
   y= c(123.4 ,132.2 ,147.2 ,146.8, 161.2 ,164.6 ,195.9)
   fit=lm(y~x)
   summary(fit)
   STRES= fit$residuals / SDE(x , mean(x) , fit$residuals)
   plot(fit$fitted.values,STRES, main="question 5a")
   #question 5b
   qqnorm(STRES , main="question 5b" )
   qqline(STRES)
   #question 5c
   plot(x,y,main="question 5c")
}
question4()
question5()
```

Complete Source Code

Please refer to this link if the picture is not clear

https://github.com/MichaelVanHouHei/R_Lectures/blob/main/homework7.R

4(b) Before I am using R to graph the data, I prefer the pattern will be similar to normal distribution since that t-distribution have the heavier tails

4 (c) as the four random graph shows ,it same as my expectation

5(a) well, there seems like no peculiar pattern emerge.

(b) it seems to be there are outliners according to the graph , the graph illustrate that residual match to normal but the last point doesn't

© as we denoted that , the region starting from x (around 65) to (71) nearly closing to a line , but the first and the last point doesn't follow , which match to the evidence from our "question 5b" graph .

Math 2009 — draft.

DB92728-3 VAN HOU MATH

1. $\sum_{i=1}^{n} x_i \hat{e}_i = 0$ — (1), $e_i = (y_i - \hat{b} x_i)$ — (2)

Expand: $\sum_{i=1}^{n} x_i y_i - \hat{b} \sum_{i=1}^{n} x_i^2 = 0$

move all to right expect $\hat{b}$, so $\hat{b} = \frac{\sum x_i y_i}{\sum x_i^2}$

2. By using calculus

$\frac{d}{db}\left(\sum e^2\right)$, $e^2 = y_i - bx_i$

Apply chain rules: $-2\sum_{i=1}^{n} x_i (x_i - b_i) = 0$

$\sum x_i (y_i - b_i) = 0$

$b = \frac{\sum x_i y_i}{\sum x_i^2}$

3. var($\hat{b}$)

from question 1, 2, $\hat{b} = \frac{\sum x_i y_i}{\sum x_i}$

$\frac{1}{(\sum x)^2} \text{var}\left(\sum x_i y_i\right)$

$= \frac{1}{(\sum x)^2} \left(\sum x^2 \text{var}(x)\right)$.

$= \frac{1}{\sum x_i^2} \sigma^2$, $\sigma^2 = \frac{\sum x_i^2 \text{var}(y)}{\sum x_i}$