Problem 1

use 20.12

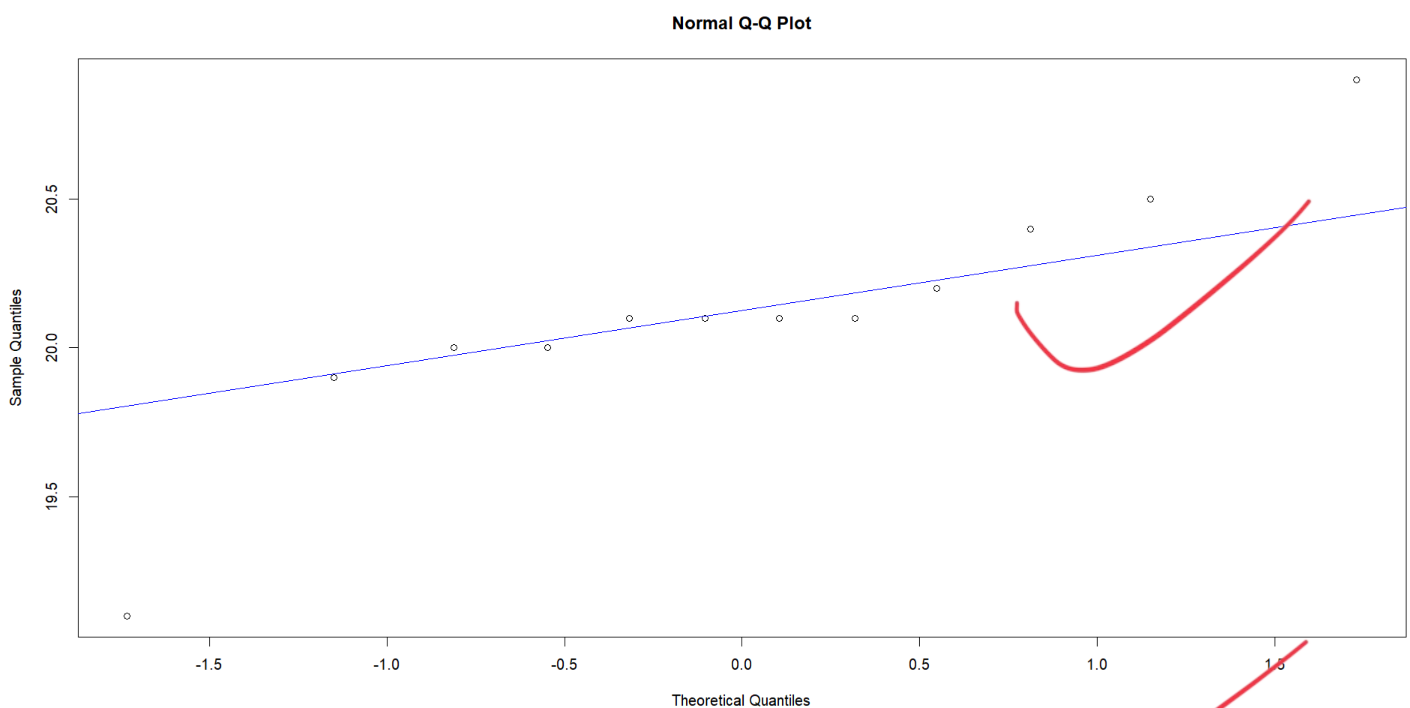
(1)

sample mean - 20.1167
sample variance - 0.1779
sample standard deviation - 0.4218

19/20

(2)

Q-Q plot



The majority of the points align closely with the reference line, suggesting that the central portion of the data follows a normal distribution. However, there is a significant deviation at the lower end.

(3)

The population of bottle fills is normally distributed with mean μ=20.2 oz and standard deviation σ=0.40 oz. We need to calculate the Pr(X < 20.1) where X ~ N(20.2, 0.4^2)

Z- score = Z = (20.1 - 20.2) / 0.4 = (-0.1) / 0.4 = -0.25

Pr(Z < - 0.25) = 0.4013

$Pr(Z < -0.25)$
$= Pr(Z > 0.25) = \ldots$

-1

(4)

We need to calculate the Pr(Xbar < 20.1)
Z - score = (20.1 - 20.2) / (0.4 / sqrt(12) = -0.1 / 0.11547 = -0.866

From the standard normal table,
Pr(Z < -0.866) = 0.1932

use either $Pr(Z < -0.86)$

or $Pr(Z < -0.87)$

(5)

Probability for a single bottle volume
pnorm(q = 20.1, mean = 20.2, sd = 0.4)
0.4013

Probability for the sample mean of 12 bottles
# Standard error = 0.4 / sqrt(12)
pnorm(q = 20.1, mean = 20.2, sd = 0.4 / sqrt(12))
0.1932

 # R code

```
# (1)
drink <- c(20.1, 20.1, 20.0, 19.9, 20.5, 20.9, 20.1, 20.4, 20.2, 19.1, 20.1, 20.0)
mean(drink)
var(drink)
std(drink)

#(2)
qqnorm(drink, main = "Q-Q Plot for Drink Volume")
qqline(drink, col = "blue")
```