

Worksheet13

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```
set.seed(51)
```

```
#Solution 1
```

```
x = c(75, 76, 73, 75, 74, 73, 73, 76, 73, 79, 77, 75)
```

```
#Solution 1.a
```

```
#sigma = 1.5, 1-alpha=0.95
```

```
zcinf = function(v){  
  n = length(v)  
  Z = qnorm(0.95/2,lower.tail=FALSE)  
  c(mean(v)-Z*1.5/sqrt(n),mean(v)+Z*1.5/sqrt(n))  
}  
zcinf(x)
```

```
## [1] 74.88951 74.94382
```

```
#Solution 1.b
```

```
#1-alpha = 0.95
```

```
tcinf = function(v){  
  n = length(v)  
  Z = qnorm(0.95/2,lower.tail=FALSE)  
  c(mean(v)-Z*sd(v)/sqrt(n),mean(v)+Z*sd(v)/sqrt(n))  
}  
tcinf(x)
```

```
## [1] 74.88262 74.95071
```

```
#Solution 1.c
```

```
#Case 1-> Null hypothesis: mu = 0
```

```
t.test(x)
```

```
##  
## One Sample t-test  
##  
## data: x  
## t = 137.97, df = 11, p-value < 2.2e-16  
## alternative hypothesis: true mean is not equal to 0  
## 95 percent confidence interval:  
## 73.72158 76.11175  
## sample estimates:  
## mean of x  
## 74.91667
```

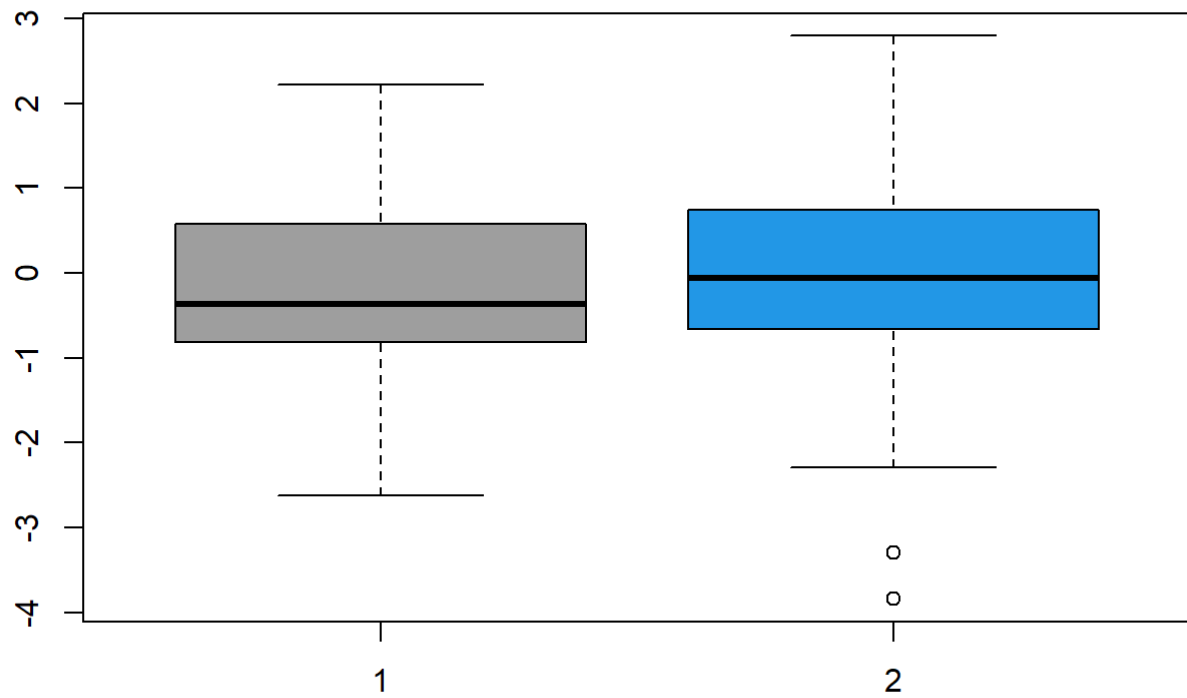
```
#The test statistic is t= 137.97 and the degrees of freedom is 11
#since n = 12. p-value returns the probability of not rejecting the
#null Hypothesis, p-value=2.2e-16. Since we have H0: mu =0, hence
#alternate hypothesis is mu != 0. The t.test by default
#finds the 95% confidence interval which for our sample is,
#(73.72158, 76.11175). Since this is a one sample test it estimates
# mean, which is 74.91667.
#Since the p-value<0.05 , we reject the null hypothesis in this case.
```

```
#Case 2-> Null hypothesis: mu = mean(x)
t.test(x,mu=mean(x))
```

```
##
## One Sample t-test
##
## data: x
## t = 0, df = 11, p-value = 1
## alternative hypothesis: true mean is not equal to 74.91667
## 95 percent confidence interval:
## 73.72158 76.11175
## sample estimates:
## mean of x
## 74.91667
```

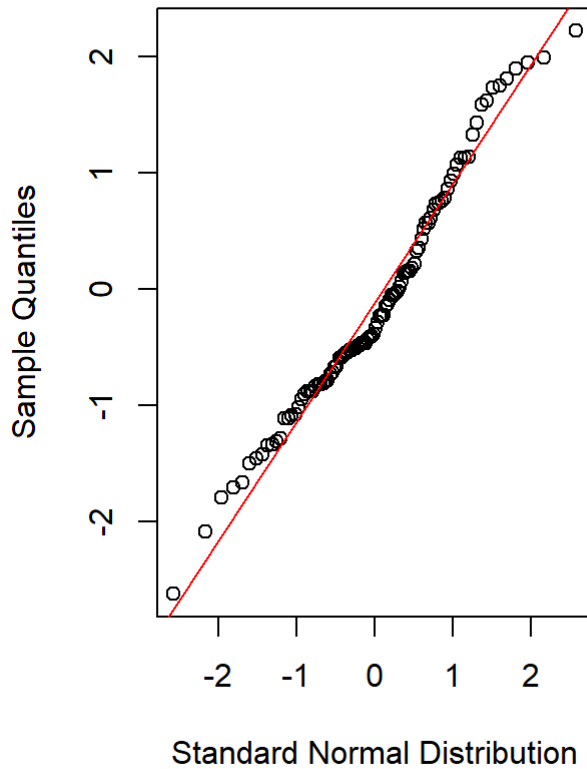
```
#The test statistic is t= 0 and the degrees of freedom is 11
#since n = 12. p-value returns the probability of not rejecting the
#null Hypothesis, p-value=1. Since we have H0: mu =mean(x), hence
#alternate hypothesis is mu != mean(x). The t.test by default
#finds the 95% confidence interval which for our sample is,
#(73.72158, 76.11175). Since this is a one sample test it estimates
# mean, which is 74.91667.
#Since the p-value>0.05 , we can't reject the null hypothesis in this case.
```

```
#Solution 2.a
x1 = rnorm(100,mean=0,sd=1)
x2 = rt(100,df=25)
boxplot(x1,x2, col=c(8,4))
```

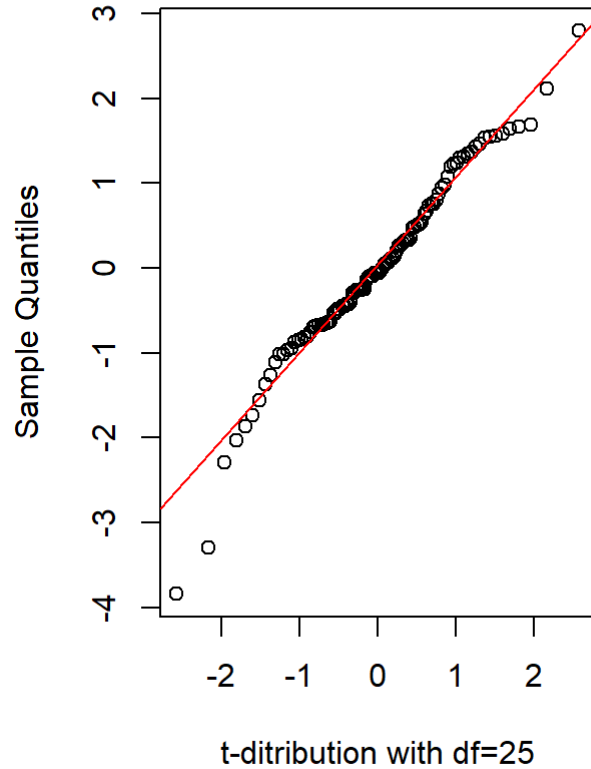


```
par(mfrow=c(1,2))
qqnorm(x1,xlab='Standard Normal Distribution')
qqline(x1,col='red')
qqnorm(x2,xlab='t-ditribution with df=25')
qqline(x2,col='red')
```

Normal Q-Q Plot

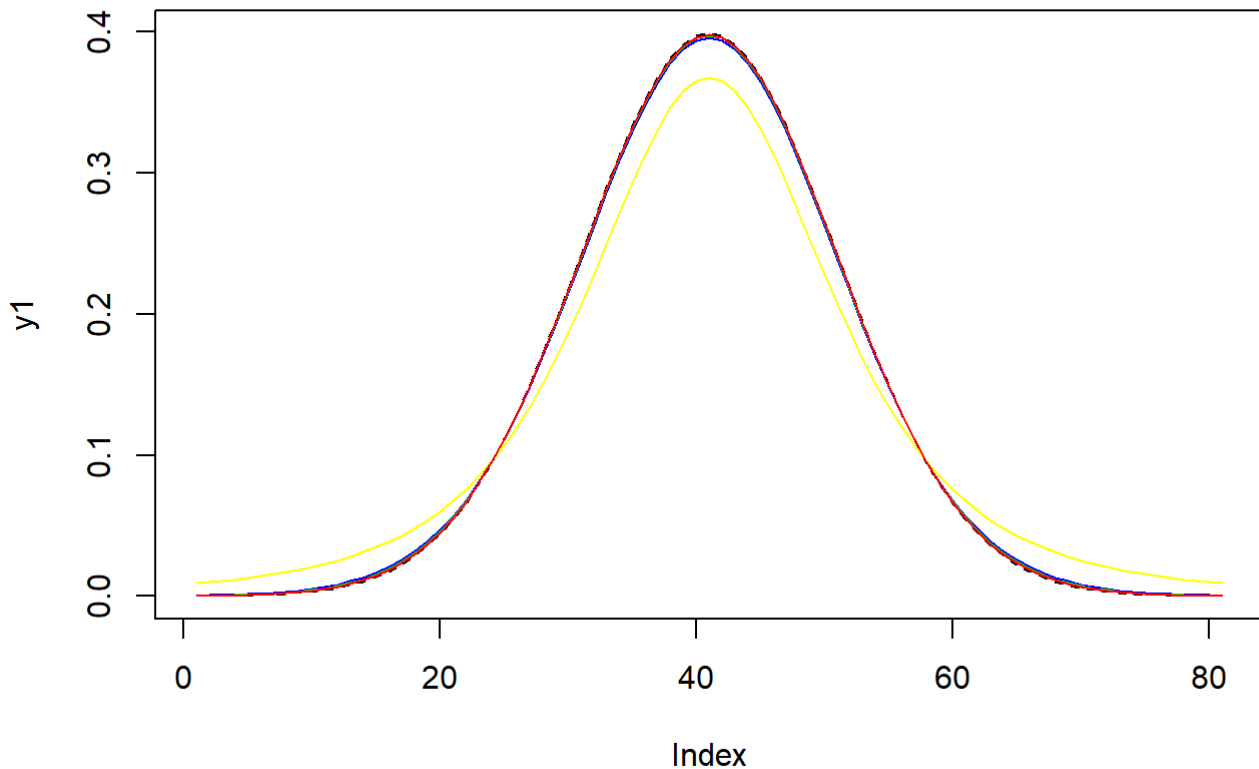


Normal Q-Q Plot



*#We can see both the normal qq plots are almost the same, but near the
#end both start deviating from the qqline.*

```
#Solution 2.b
k=c(3, 33, 66, 99)
ran_x = seq(-4,4,by=0.1)
y1 =dnorm(ran_x)
plot(y1,type="l", lty=2)
y2= dt(ran_x,df=3)
lines(y2,col='yellow')
y2= dt(ran_x,df=33)
lines(y2,col='blue')
y2= dt(ran_x,df=66)
lines(y2,col='green')
y2= dt(ran_x,df=99)
lines(y2,col='red')
```



*#We can see as we increase the degrees of freedom, the coloured smooth lines
#start to overlap with the dashed line representing normal distribution.
#We can say as the degree of freedom increases, t distribution starts behaving
#like a normal distribution*

#Solution 3

```
prop.test(45,100)
```

```
##
## 1-sample proportions test with continuity correction
##
## data: 45 out of 100, null probability 0.5
## X-squared = 0.81, df = 1, p-value = 0.3681
## alternative hypothesis: true p is not equal to 0.5
## 95 percent confidence interval:
##  0.3514281 0.5524574
## sample estimates:
##      p
## 0.45
```

```
#We have 45 heads out of 100 tosses. The assumed null hypothesis is 0.5,
#since we are testing for a fair coin. X-squared is 0.81 which is the test
#statistic and the degrees of freedom is df=1. We can see p-value is 0.3681.
#The 95% confidence interval is calculated to be (0.3514281, 0.5524574) and the
#sample estimate of the probability of a head is 0.45.
#Since p-value = 0.3681 > 1-0.95, we can't reject the null hypothesis. Also, note
#that 0.5 lies in the confidence interval calculated by prop.test(), hence
#the coin might or might not be a fair one.
```

```
#Solution 4
prop.test(4500,10000)
```

```
##
## 1-sample proportions test with continuity correction
##
## data: 4500 out of 10000, null probability 0.5
## X-squared = 99.8, df = 1, p-value < 2.2e-16
## alternative hypothesis: true p is not equal to 0.5
## 95 percent confidence interval:
## 0.4402205 0.4598181
## sample estimates:
## p
## 0.45
```

```
#We have 4500 heads out of 10000 tosses. The assumed null hypothesis is 0.5,
#since we are testing for a fair coin. X-squared is 99.8 which is the test
#statistic and the degrees of freedom is df=1. p-value is less than 2.2e-16.
#The 95% confidence interval is calculated to be (0.4402205, 0.4598181) and the
#sample estimate of the probability of a head is 0.45.
#Since p-value < 1-0.95, we reject the null hypothesis. Also, note
#that 0.5 does not lie in the confidence interval calculated by prop.test(),
#hence the coin is not a fair one.
```

```
#Solution 5
```

```
#Claim: lifetime of a battery=25
alpha=0.05
Z= qnorm(0.95/2,lower.tail=FALSE)
c(21-Z*1.7/sqrt(10),21+Z*1.7/sqrt(10))
```

```
## [1] 20.96629 21.03371
```

```
value = 1-pt(7.441,df=9)
value<0.05
```

```
## [1] TRUE
```

```
#Since value<0.05, we can reject the null hypothesis, Also, note that
#the claimed mean 25, doesn't lie in the 95% confidence interval for
#sample mean. The claim made by Doddapple can not be believed.
```