STA305 A1

Part A

```
set.seed(6046)
yS <- round(rnorm(8,mean = 5,sd = 2),3)
yS
```

```
## [1] 4.976 4.508 5.352 4.456 4.935 5.394 2.127 5.937
```

```
set.seed(6046)
yT <- round(rnorm(8,mean = 7,sd = 2),3)
yT
```

```
## [1] 6.976 6.508 7.352 6.456 6.935 7.394 4.127 7.937
```

```
result = cbind(yS, yT)
result
```

```
##         yS    yT
## [1,] 4.976 6.976
## [2,] 4.508 6.508
## [3,] 5.352 7.352
## [4,] 4.456 6.456
## [5,] 4.935 6.935
## [6,] 5.394 7.394
## [7,] 2.127 4.127
## [8,] 5.937 7.937
```

Part B

```
diff = mean(yT) - mean(yS)

fert <- c(yT,yS); N <- choose(16,8)
res <- numeric(N) # store the results
index <-combn(1:16,8) #Generate N treatment assignments
for (i in 1:N)
{res[i] <- mean(fert[index[,i]])-mean(fert[-index[,i]])}
```

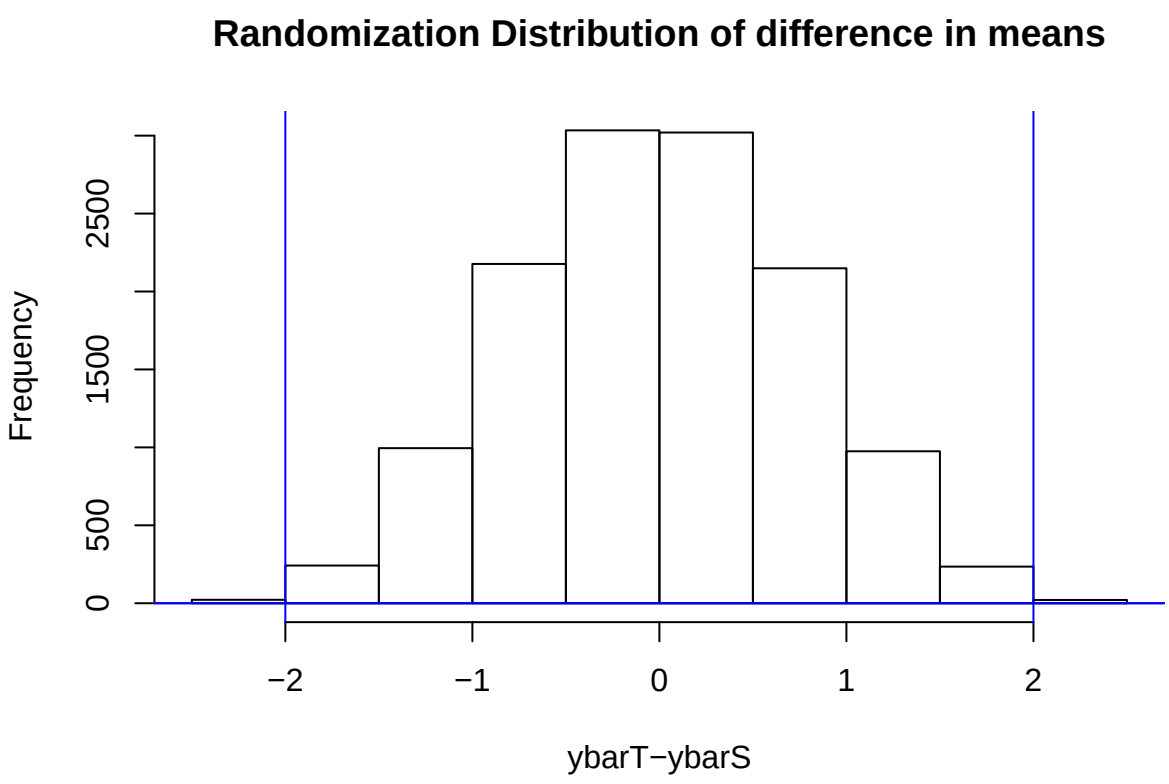
```
diff
```

```
## [1] 2
```

```
pval <- sum(res>=diff) /N
round(pval,3)
```

```
## [1] 0.002
```

```
hist(res,xlab = "ybarT-ybarS", main="Randomization Distribution of difference in means")
abline(h=0,v=2,col="blue")
abline(h=0,v=-2,col="blue")
```



i)

The distribution above is pretty normal.

values this distribution contain: 12870

probability of the observed treatment allocation: 1 / 12870

ii)

p-value is 0.002 which means under the assumption that there is no difference between S and T only 0.2% of randomizations would produce an extreme or more extreme difference than the observed mean difference.Therefore, we reject the null hypothesis and accept the "significant results" that there is difference in means between two treatments.

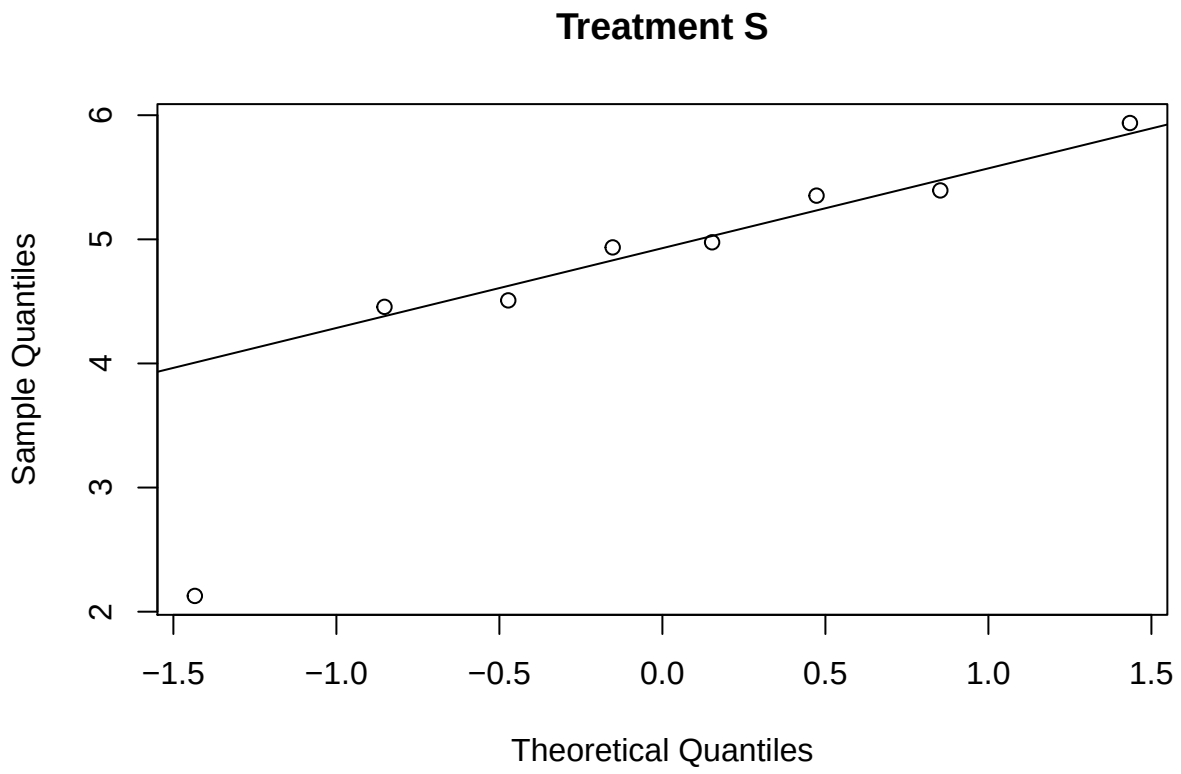
Part C

```
t.test(yS,yT,var.equal = FALSE,alternative = 'less')
```

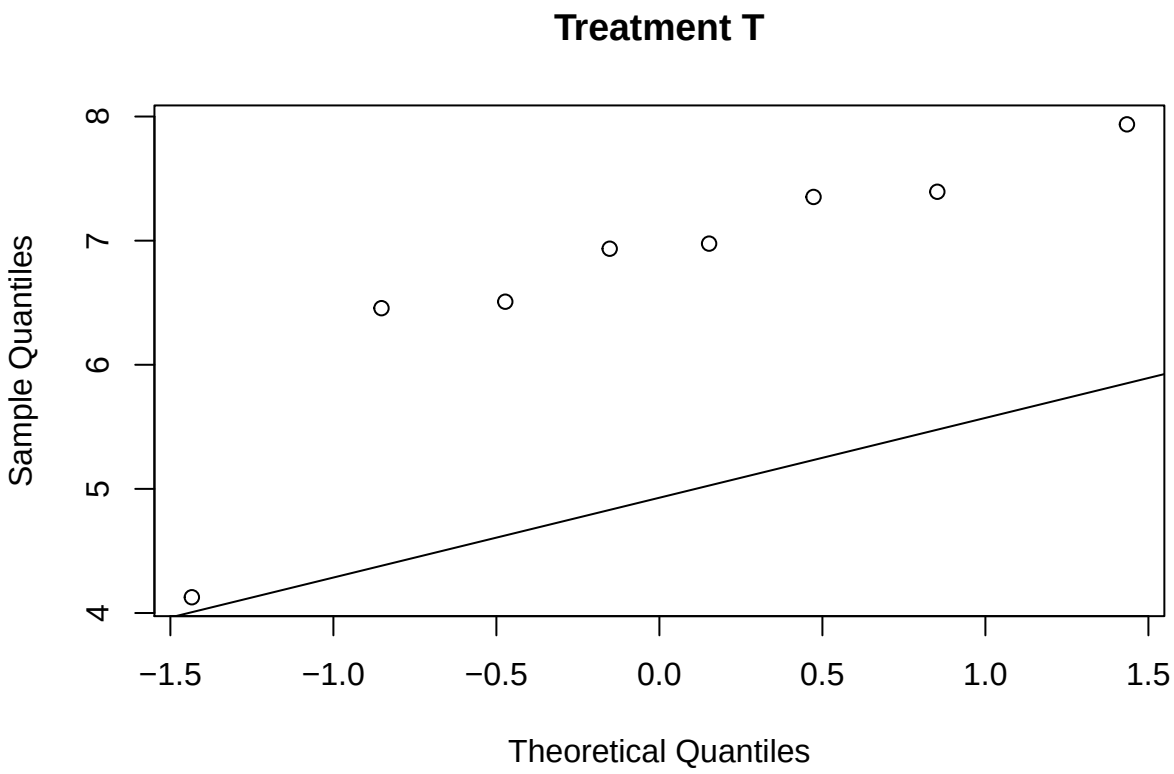
```
##
##  Welch Two Sample t-test
##
## data:  yS and yT
```

```
## t = -3.4733, df = 14, p-value = 0.001864
## alternative hypothesis: true difference in means is less than 0
## 95 percent confidence interval:
##        -Inf -0.9857908
## sample estimates:
## mean of x mean of y
##  4.710625  6.710625
```

```
qqnorm(yS,main = "Treatment S");qqline(yS)
```




```
qqnorm(yT,main = "Treatment T");qqline(yS)
```



i)

P-value is 0.001864 which is quite small so that we can reject the null hypothesis

$$\mu_S = \mu_T$$

Thus there is difference between the two treatements.

ii)

According to the 2 qq-plot, we know the normal assumption does not hold for treatement T.

iii) t-test agrees the result of randomization test because both P-values are almost identical and reject same null hypothesis.