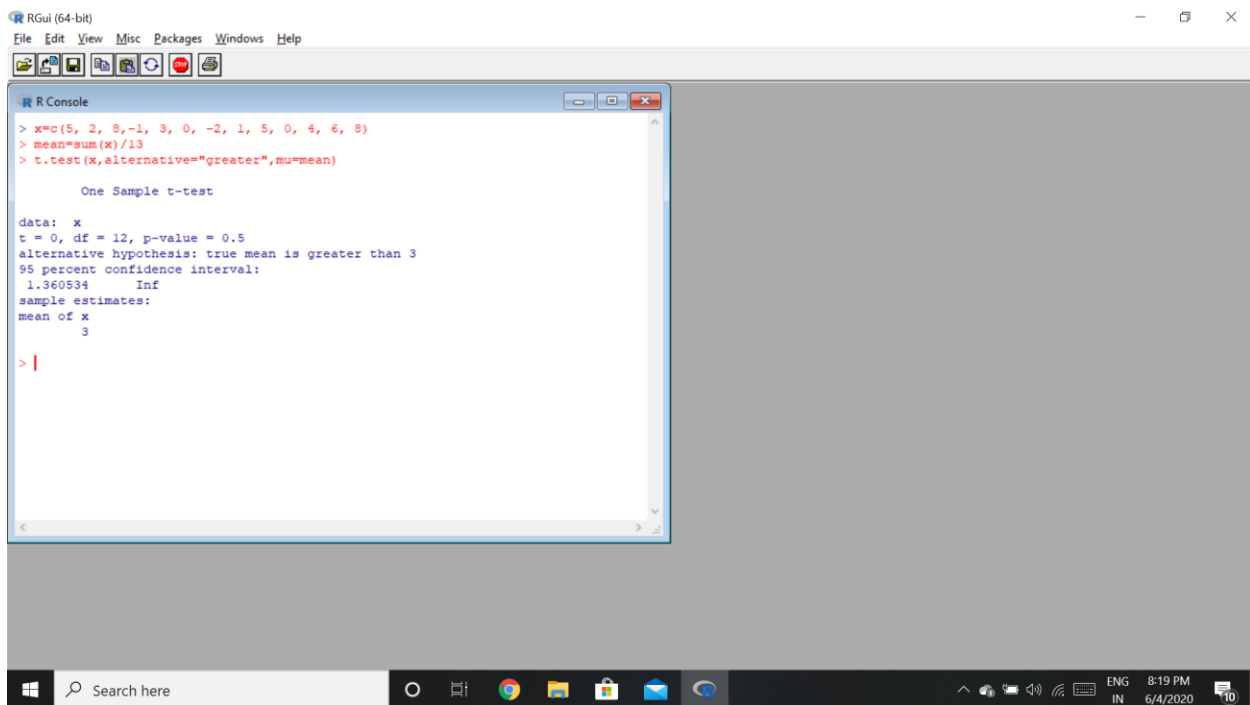


## Statistics DA 5

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Q1. A certain stimulus administered to each of the 13 patients resulted in the following increase of blood pressure: 5, 2, 8, -1, 3, 0, -2, 1, 5, 0, 4, 6, 8. Can it be concluded that the stimulus, in general, be accompanied by an increase in the blood pressure?



```
> x=c(5, 2, 8, -1, 3, 0, -2, 1, 5, 0, 4, 6, 8)
> mean=sum(x)/13
> t.test(x,alternative="greater",mu=mean)

One Sample t-test

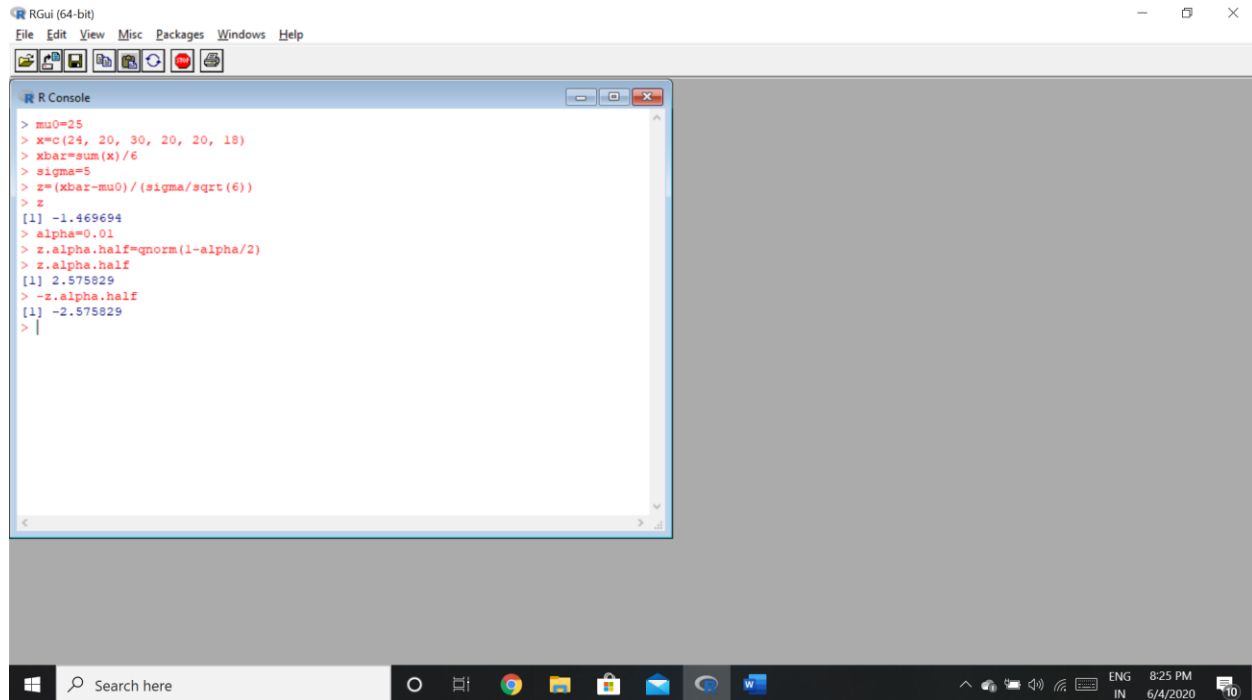
data: x
t = 0, df = 12, p-value = 0.5
alternative hypothesis: true mean is greater than 3
95 percent confidence interval:
 1.360534      Inf
sample estimates:
mean of x
      3

> |
```

Interpretation:

From the output we see that the  $p\text{-value}=0.5$  hence there is evidence that the stimulus in general will be accompanied by the increase in blood pressure

Q2. The manufacturer of a certain make of electric bulbs claims that his bulbs have a mean life of 25 months with a standard deviation of 5 months. Random samples of 6 such bulbs have the following values: Life of bulbs in months: 24, 20, 30, 20, 20, and 18. Can you regard the producer's claim to valid at 1% level of significance?



The screenshot shows the RGui (64-bit) interface. The R Console window contains the following code and output:

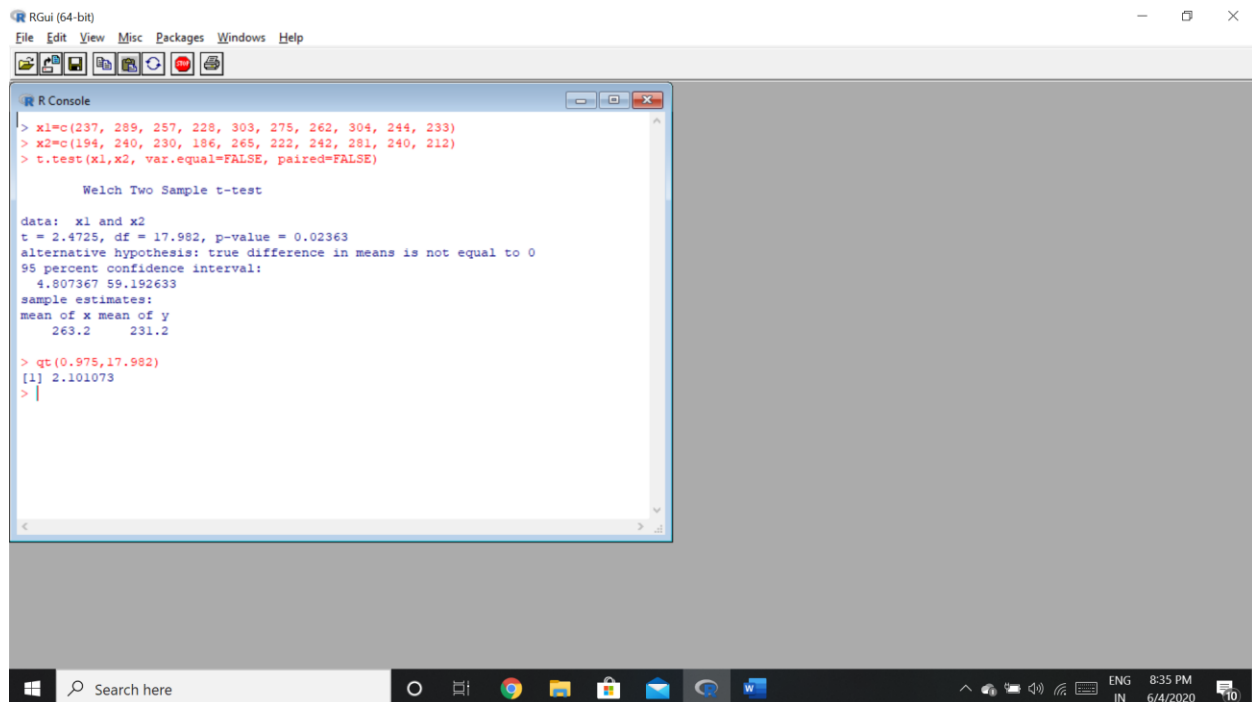
```
> mu0=25
> x=c(24, 20, 30, 20, 20, 18)
> xbar=sum(x)/6
> sigma=5
> z=(xbar-mu0)/(sigma/sqrt(6))
> z
[1] -1.469694
> alpha=0.01
> z.alpha.half=qnorm(1-alpha/2)
> z.alpha.half
[1] 2.575829
> -z.alpha.half
[1] -2.575829
> |
```

The Windows taskbar at the bottom shows the search bar, task view button, and several application icons (Chrome, File Explorer, Mail, Edge, Word). The system tray on the right indicates the date and time as 6/4/2020, 8:25 PM.

Interpretation:

The test statistic -1.469694 is between the range of -2.57 to +2.57. Hence, at .01 significance level, we accept the claim that bulbs have a mean life of 25 months.

Q3. Hypothesis Tests for Two Means: Independent Data: Test for a difference in means for the following data: Drug( $x_1$ ) 237 289 257 228 303 275 262 304 244 233 Drug( $x_2$ ) 194 240 230 186 265 222 242 281 240 212



```
RGui (64-bit)
File Edit View Misc Packages Windows Help

R Console
> x1=c(237, 289, 257, 228, 303, 275, 262, 304, 244, 233)
> x2=c(194, 240, 230, 186, 265, 222, 242, 281, 240, 212)
> t.test(x1,x2, var.equal=FALSE, paired=FALSE)

Welch Two Sample t-test

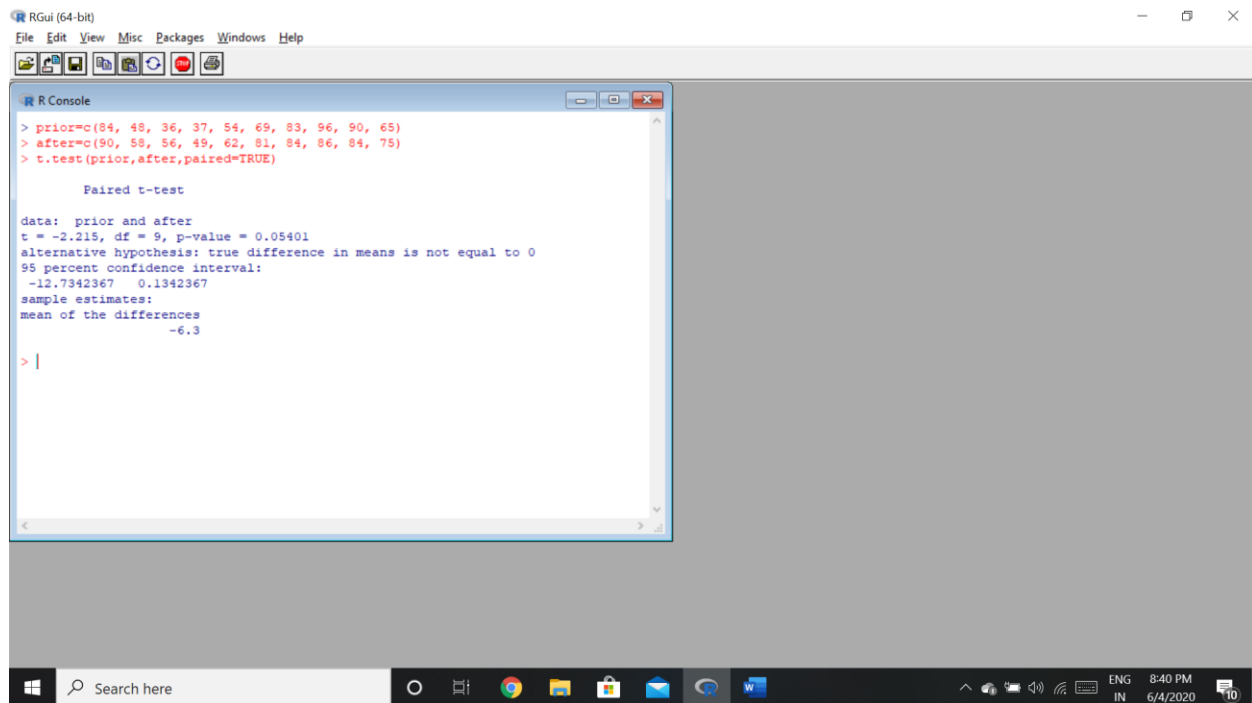
data: x1 and x2
t = 2.4725, df = 17.982, p-value = 0.02363
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 4.807367 59.192633
sample estimates:
mean of x mean of y
 263.2    231.2

> qt(0.975,17.982)
[1] 2.101073
> |
```

Interpretation:

The  $p\text{-value} < 0.05$ , we conclude that the means of the two groups are significantly similar. The value of  $t$  is greater than the tabulated  $t$ -value for 17.982 df, therefore we accept alternative hypothesis.

Q4. The Scores of 10 candidates prior and after training (paired  $t$ -test) are given below: Prior 84 48 36 37 54 69 83 96 90 65 After 90 58 56 49 62 81 84 86 84 75. Test the training is Effective or Not?



```
File Edit View Misc Packages Windows Help
R Console
> prior=c(84, 48, 36, 37, 54, 69, 83, 96, 90, 65)
> after=c(90, 58, 56, 49, 62, 81, 84, 86, 84, 75)
> t.test(prior,after,paired=TRUE)

Paired t-test

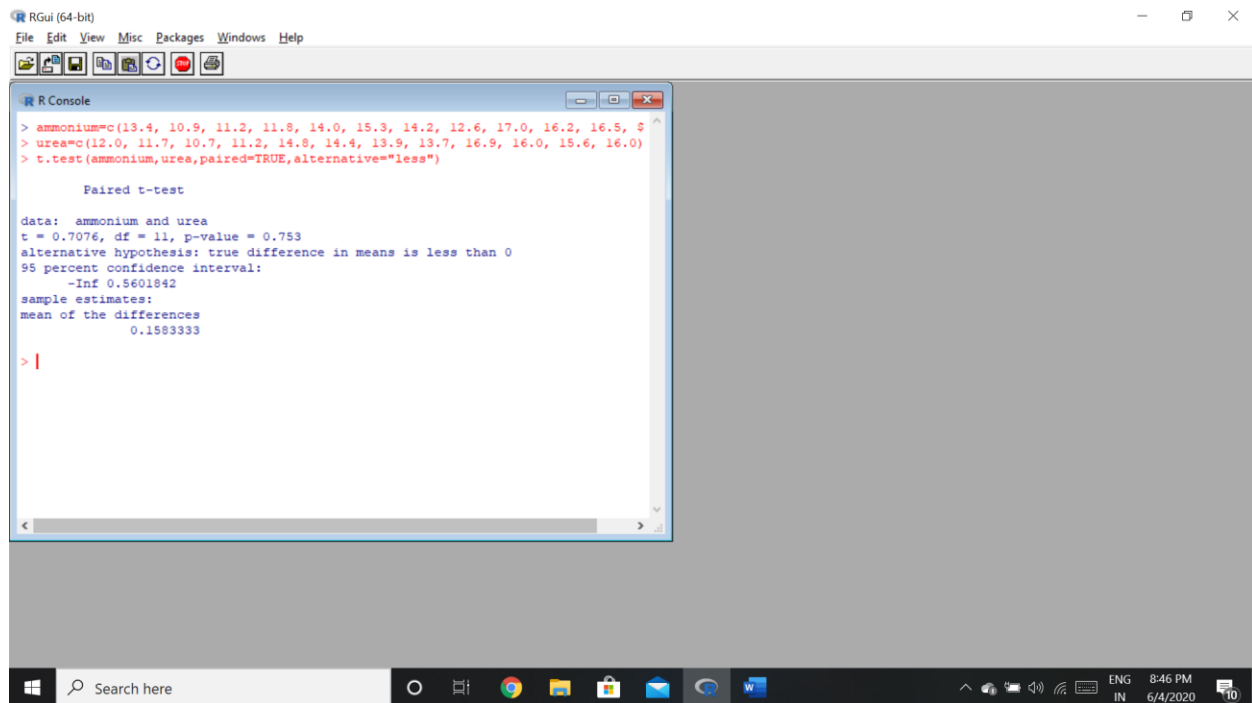
data: prior and after
t = -2.215, df = 9, p-value = 0.05401
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -12.7342367  0.1342367
sample estimates:
mean of the differences
      -6.3

> |
```

Interpretation:

The p-value is greater than 0.05, then we do not reject the hypothesis  $H_0$  of equality of the averages and conclude that the new training has not made any significant improvement.

Q5. In order to compare the effectiveness of two sources of nitrogen, namely ammonium chloride and urea on grain yield of paddy, an experiment was conducted. The results on the grain yield of paddy (kg/plot) under the two treatments are given below: Ammonium chloride 13.4 10.9 11.2 11.8 14.0 15.3 14.2 12.6 17.0 16.2 16.5 15.7 Urea 12.0 11.7 10.7 11.2 14.8 14.4 13.9 13.7 16.9 16.0 15.6 16.0 Assess which sources nitrogen is better for paddy?



```
RGui (64-bit)
File Edit View Misc Packages Windows Help

R Console
> ammonium=c(13.4, 10.9, 11.2, 11.8, 14.0, 15.3, 14.2, 12.6, 17.0, 16.2, 16.5, 9
> urea=c(12.0, 11.7, 10.7, 11.2, 14.8, 14.4, 13.9, 13.7, 16.9, 16.0, 15.6, 16.0)
> t.test(ammonium,urea,paired=TRUE,alternative="less")

Paired t-test
data: ammonium and urea
t = 0.7076, df = 11, p-value = 0.753
alternative hypothesis: true difference in means is less than 0
95 percent confidence interval:
 -Inf 0.5601842
sample estimates:
mean of the differences
 0.1583333

> |
```

### Interpretation:

The p-value (0.753) is greater than the level of significance (0.05). So we do not reject our null hypothesis. Hence, the ammonium chloride is the better nitrogen source for paddy.