17BIT0028

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LAB-11

Paired t-test And F- (Variance Ratio Test)

AIM: to analyse the improvement or effectiveness of a new methodology adopted. And also test the hypothesis for variance ratio.

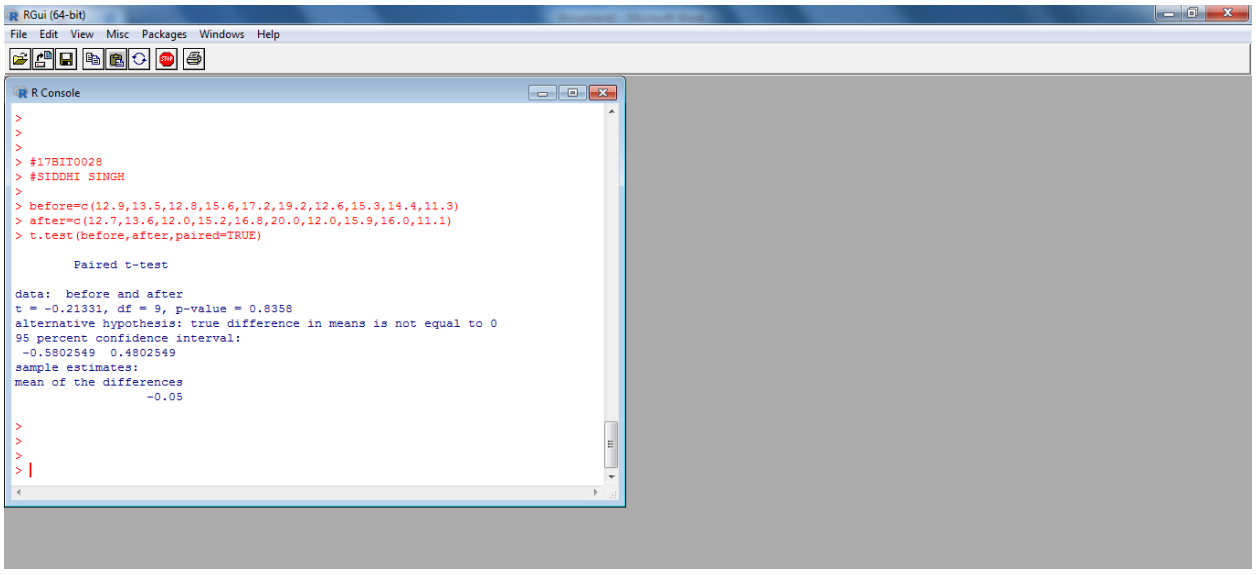
HYPOTHESIS TESTS FOR MEAN DIFFERENCES: PAIRED DATA-t-TEST

Problem 1 :

A school athletics has taken a new instructor, and want to test the effectiveness of the new type of training proposed by the new instructor comparing the average times of 10 runners in the 100 meters. The results are given below(time in seconds)

Before training	*12.9*	*13.5*	*12.8*	*15.6*	*17.2*	*19.2*	*12.6*	*15.3*	*14.4*	*11.3*
After training	*12.7*	*13.6*	*12.0*	*15.2*	*16.8*	*20.0*	*12.0*	*15.9*	*16.0*	*11.1*

Solution: *In this case we have two sets of paired samples, since the measurements were made on the same athletes before and after the workout. To see if there was an improvement, deterioration, or if the means of times have remained substantially the same (hypothesis H0), we need to make a Student's t-test for paired samples, proceeding in this way*



Interpretation :-

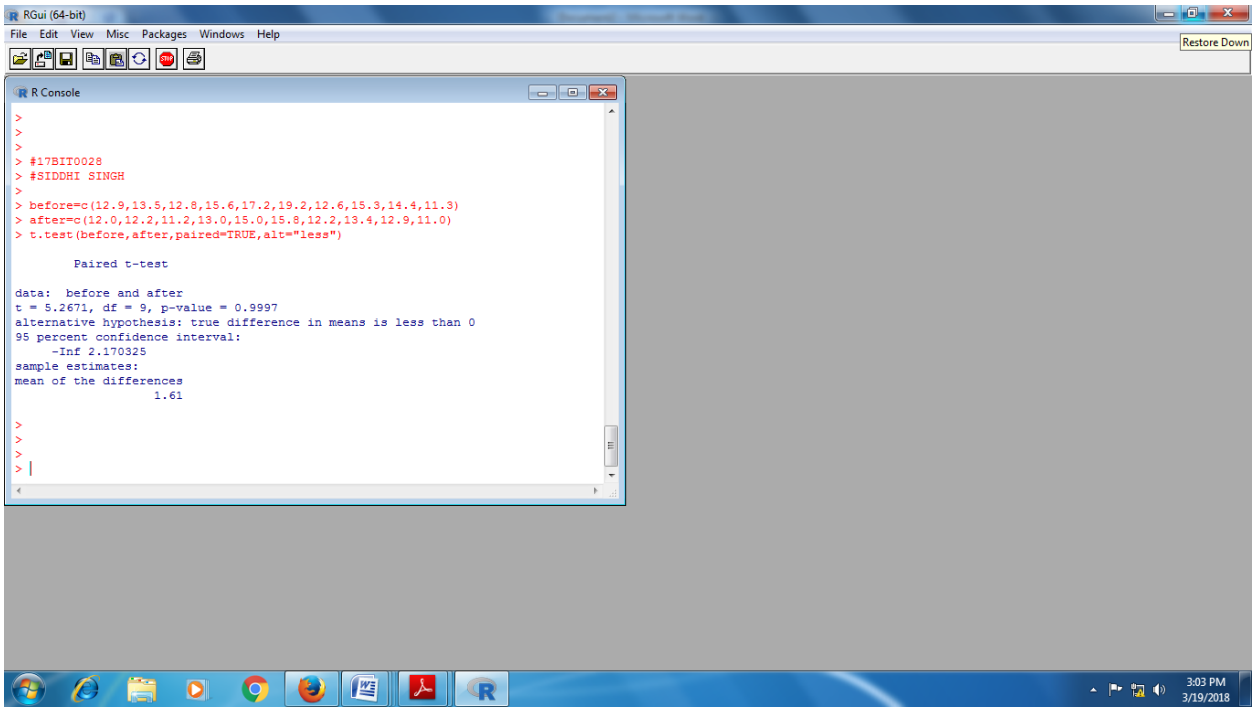
The p-value is greater than 0.05, then we do not reject the hypothesis H_0 of equality of the averages and conclude that the new training has not made any significant improvement to the team of athletes.

Problem 2 :-

Suppose now that the manager of the team (given the results obtained) fired the coach who has not made any improvement, and take another, more promising. We report the times of athletes after the second training:

Before training:	*12.9*	*13.5*	*12.8*	*15.6*	*17.2*	*19.2*	*12.6*	*15.3*	*14.4*	*11.3*
After the second training:	*12.0*	*12.2*	*11.2*	*13.0*	*15.0*	*15.8*	*12.2*	*13.4*	*12.9*	*11.0*

Now we check if there was actually an improvement, ie perform a t-test for paired data, specifying in R to test the alternative hypothesis H1 of improvement in times. To do this simply add the syntax alt = "less" when you call the t-test:



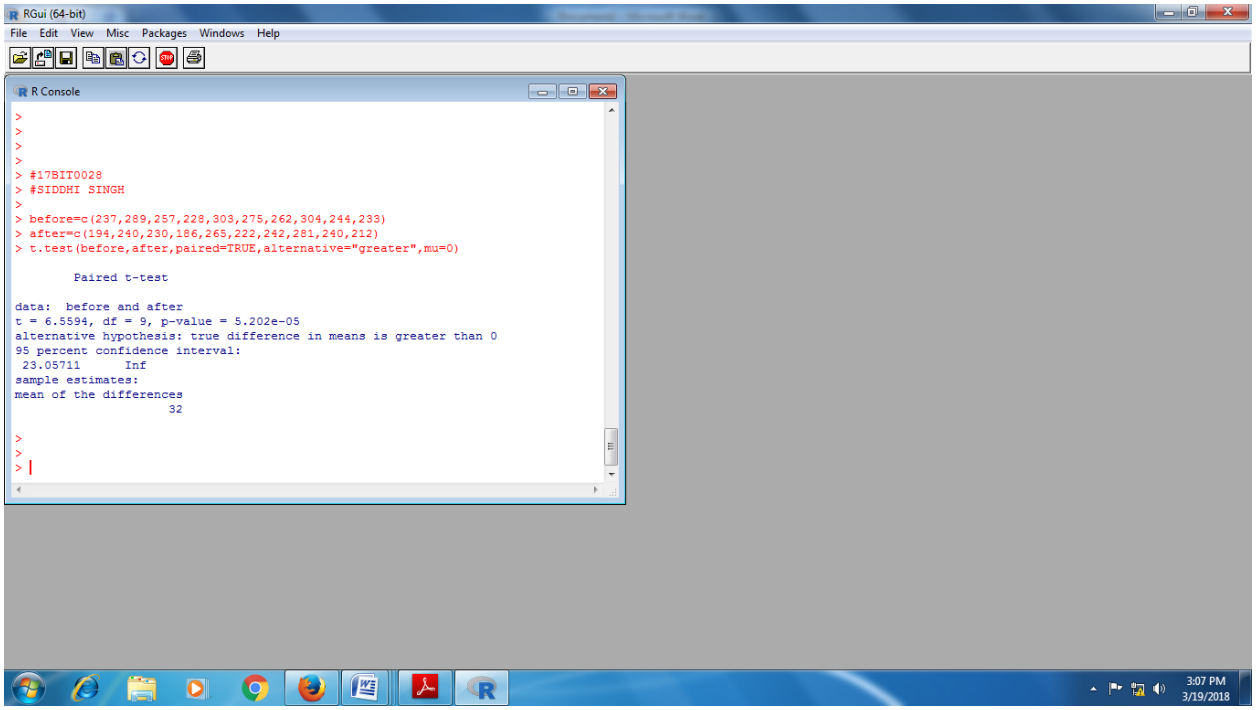
Interpretation:-

In response, we obtained a p-value well above 0.05, which leads us to conclude that we can reject the null hypothesis H_0 in favour of the alternative hypothesis H1: the new training has made substantial improvements to the team.

Problem 3 *: Consider the paired data below that represents cholesterol levels on 10 men before and after a certain medication*

Before(x)	*237*	*289*	*257*	*228*	*303*	*275*	*262*	*304*	*244*	*233*
After(y)	*194*	*240*	*230*	*186*	*265*	*222*	*242*	*281*	*240*	*212*

Test the claim that, on average, the drug lowers cholesterol in all men. I.e., test the claim that $\mu_d > 0$. *Test this at the 0.05 significance level.*



Interpretation :-

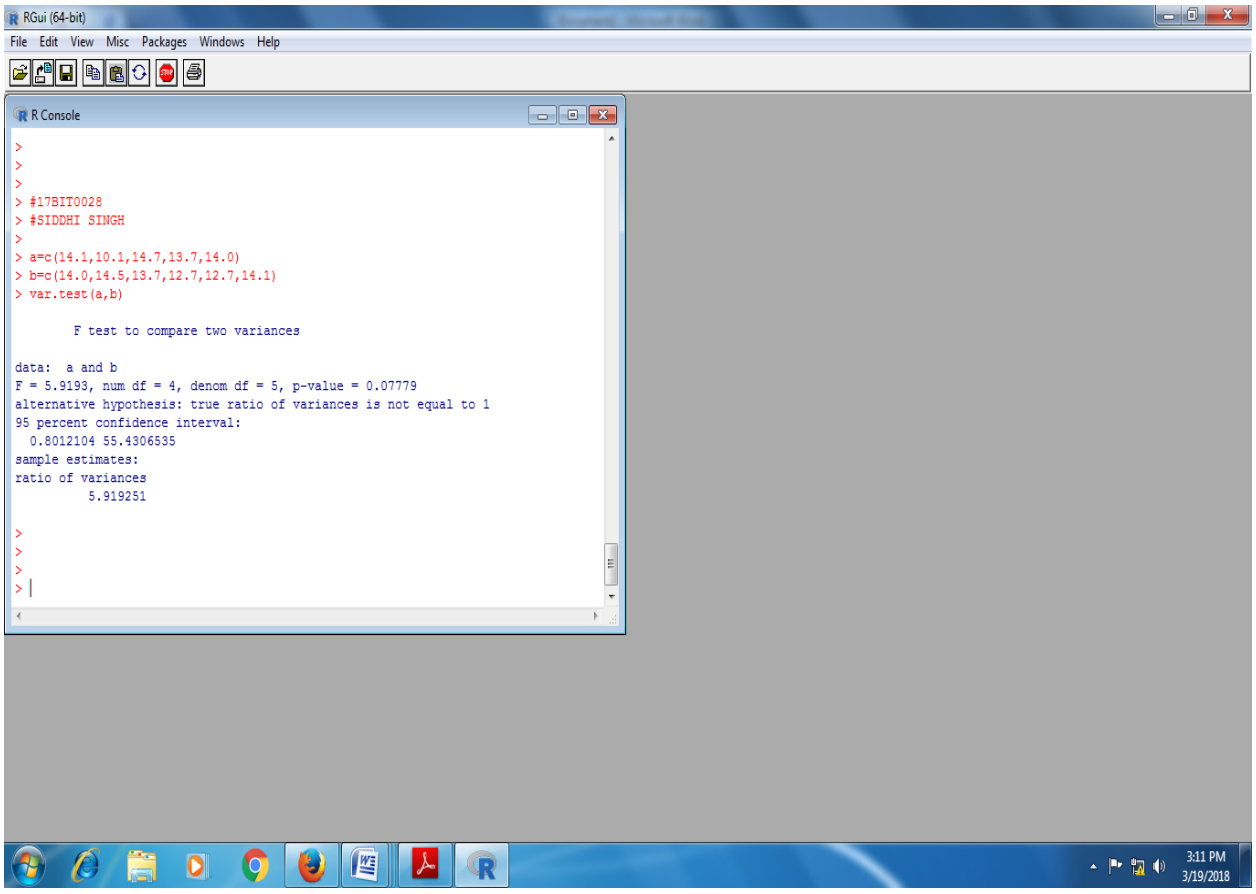
We can reject the null hypothesis and support the claim because the P-value ($\approx 5.2X10^{-5}$) is less than the signicance level.

F Test to Compare Two Variances

Problem 1 :-

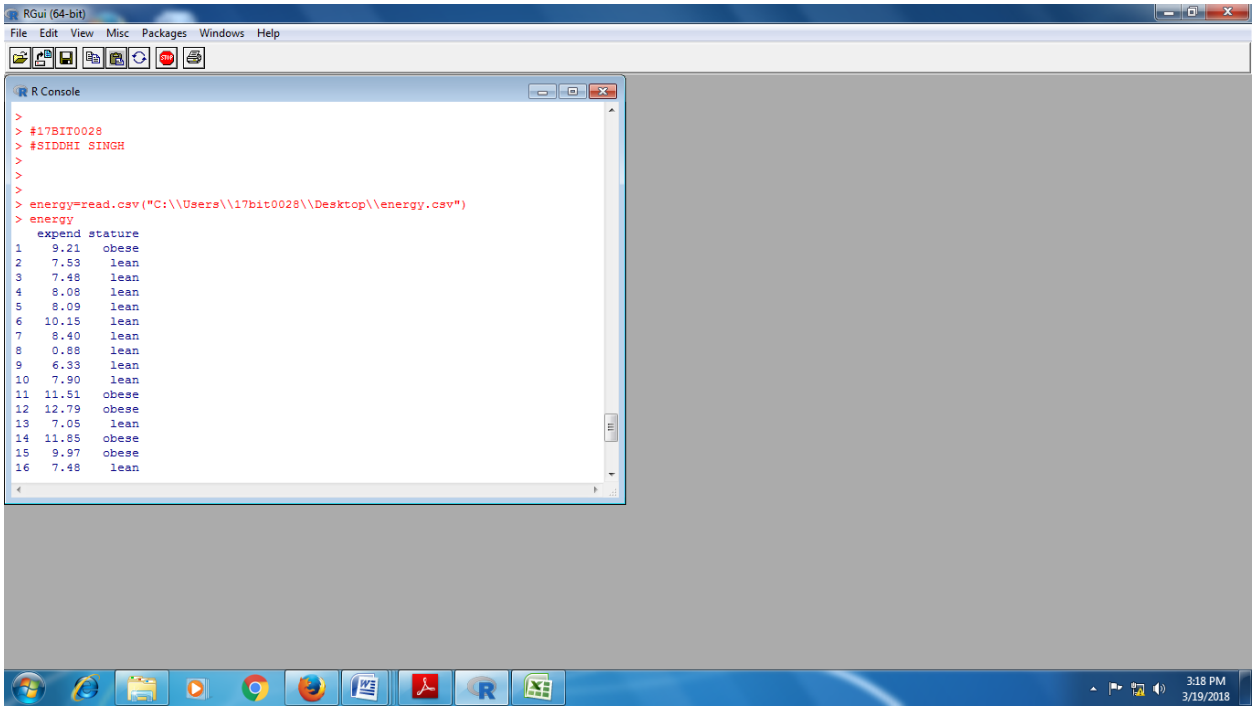
Five Measurements of the output of two units have given the following results (in kilograms of material per one hour of operation) .Assume that both samples have been obtained from normal populations, test at 10% significance level if two populations have the same variance.

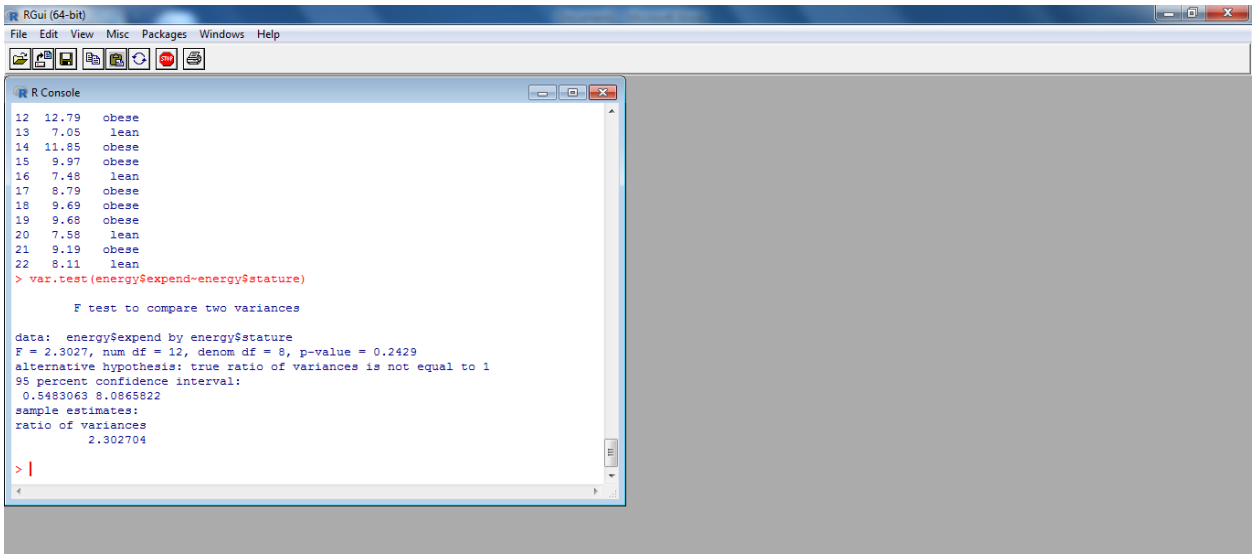
Unit A	*14.1*	*10.1*	*14.7*	*13.7*	*14.0*
Unit B	*14.0*	*14.5*	*13.7*	*12.7*	*14.1*



Inference : here p valuve >0.05 ,then there is no evidence to reject the null hypothesis.

Problem 2: Energy Data :- (Variance Ratio-test)





Inference :

Here p valuve >0.05 ,then there is no evidence to reject the null hypothesis.

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PAIRED T-TEST AND F-TEST

```
> before = c(12.9, 13.5, 12.8, 15.6, 17.2, 19.2,
             12.6, 15.3, 14.4, 11.3)
> after = c(12.7, 13.6, 12.0, 15.2, 16.8, 20.0,
            12.0, 15.9, 16.0, 11.1)
> t.test(before, after, paired = TRUE)

> before = c(12.9, 13.5, 12.8, 15.6, 17.2, 19.2, 12.4,
             15.3, 14.4, 11.3)
> after = c(12.0, 12.2, 11.2, 13.0, 15.0, 15.8, 12.2,
            13.4, 12.9, 11.0)
> t.test(before, after, paired = TRUE, alt = "less")

> before = c(237, 289, 257, 303, 275, 262, 304,
             244, 233)
> after = c(194, 240, 230, 186, 263, 222, 241, 281,
            240, 212)
> t.test(before, after, paired = TRUE, alternative = "greater",
         mu = 0)

> a = c(14.1, 10.1, 14.7, 13.7, 14.0)
> b = c(14.0, 14.5, 13.7, 12.7, 12.7, 14.1)
> var.test(a, b)

> energy = read.csv("C:\\Users\\17bit0028\\Desktop\\
           energy.csv")
> var.test(energy$expend ~ energy$stature)
```