SMALL SAMPLE TEST (T-TEST)

LAB Experiment 5

JULY 6, 2021

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Small Sample Test

- t-test for Single Mean.
  and
  t-test for difference of Mean.

Problem-1

An outage of Salmonella-related illness was attributed to ice produced at a certain factory. Scientists measured the level of Salmonella in 9 randomly sampled batches ice cream. The levels (in MPN/g) were:-

0.593 0.142 0.329 0.691 0.231 0.793 0.519
0.392 0.418.

Is there evidence that the Mean level of Salmonella in ice cream greater than 0.3 MPN/g?

R-codes:-

```
>x=c(0.593, 0.142, 0.329, 0.691, 0.231, 0.793, 0.519, 0.392, 0.418)
>t.test(x, alternative = "greater", mu=0.3).
```

Output:-

```
One sample t-test.

data: x
t = 2.2051, df = 8, p-value = 0.02927.
Alternative hypothesis: true mean is greater than 0.3.
95 percent confidence interval:
0.3245133     Inf
Sample estimates:
mean of x
0.4564444
```

Inference:-

From the output, we see that the p-value = 0.029. Hence, there is moderately strong evidence that the mean Salmonella level in ice-cream is above 0.3 MPN/g.

```
>
> x=c(0.593, 0.142, 0.329, 0.691, 0.231, 0.793, 0.519, 0.392, 0.418)
> x
[1] 0.593 0.142 0.329 0.691 0.231 0.793 0.519 0.392 0.418
>
> t.test(x, alternative = "greater", mu=0.3)

        One Sample t-test

data:  x
t = 2.2051, df = 8, p-value = 0.02927
alternative hypothesis: true mean is greater than 0.3
95 percent confidence interval:
 0.3245133       Inf
sample estimates:
mean of x
0.4564444

> |
```

Problem - 2

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

$H_0: S_1^2 = S_2^2$

$H_1: S_1^2 \neq S_2^2$

R-codes:-

```
>Unit_A = c( 14.1, 10.1, 14.7, 13.7, 14.0) .
>Unit_B = c(14.0, 14.5, 13.7, 12.7, 14.1) .
>var.test ( Unit_A, Unit_B).
```

Outputs:-

F-test to compare two variances.

data: Unit_A and Unit_B .

F = 7.3304, num df = 4, denom df = 4, p-value = 0.07954.

alternative hypothesis: true ratio of variances is not equal to 1

95 percent confidence interval:-

0.7632268   70.4053799

sample estimates:-

ratio of variances

7.330435

Inferences:-

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

```
> Unit_A =c(14.1, 10.1, 14.7, 13.7, 14.0)
> Unit_A
[1] 14.1 10.1 14.7 13.7 14.0
>
> Unit_B = c(14.0, 14.5, 13.7, 12.7, 14.1)
> Unit_B
[1] 14.0 14.5 13.7 12.7 14.1
>
> var.test(Unit_A, Unit_B)

        F test to compare two variances

data:  Unit_A and Unit_B
F = 7.3304, num df = 4, denom df = 4, p-value = 0.07954
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
  0.7632268 70.4053799
sample estimates:
ratio of variances
          7.330435

>
```