**B. Perform testing of hypothesis using two sample t-test.**

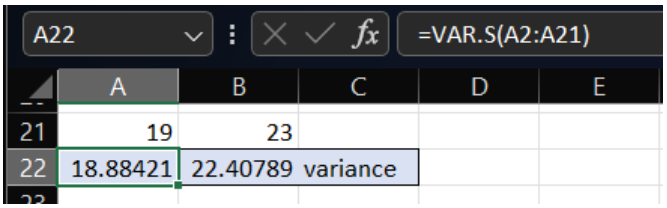
Suppose researchers want to know whether or not two different species of plants in a particular country have the same mean height. Because it would take too long to go around and measure every single plant, they decide to collect a sample of 20 plants from each species.

The following data shows the height (in inches) for each plant in each sample:

| species 1 | species 2 |
|---|---|
| 12 | 10 |
| 12 | 24 |
| 20 | 17 |
| 12 | 23 |
| 24 | 19 |
| 25 | 16 |
| 10 | 10 |
| 15 | 14 |
| 16 | 19 |
| 21 | 14 |
| 21 | 12 |
| 11 | 21 |
| 12 | 12 |
| 16 | 12 |
| 15 | 11 |
| 17 | 21 |
| 17 | 18 |
| 14 | 23 |
| 19 | 16 |
| 19 | 23 |

When we conduct a two-sample t-test, we must first decide if we will assume that the two populations have equal or unequal variances. As a rule of thumb, we can assume the populations have equal variances if the ratio of the larger sample variance to the smaller sample variance is less than 4:1.

To calculate the variance of two samples Click on cell A22 and type = VAR.S(A2:A21) Click on cell B22 and type = VAR.S(B2:B21)

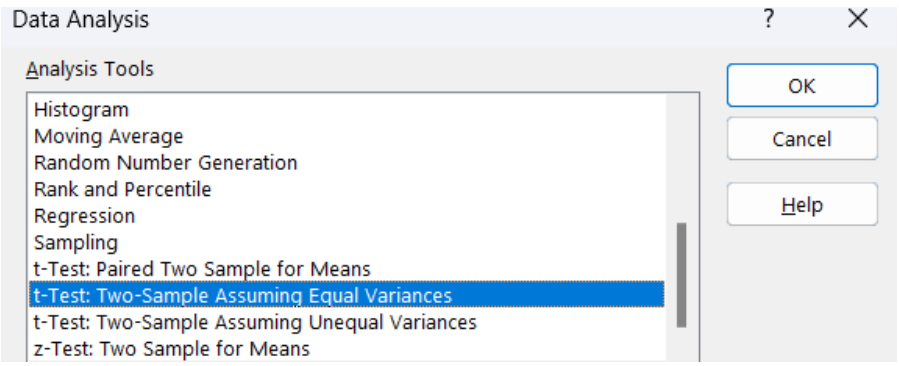



The ratio of the larger sample variance to the smaller sample variance is 1.1865, which is less than 4. This means we can assume that the population variances are equal.

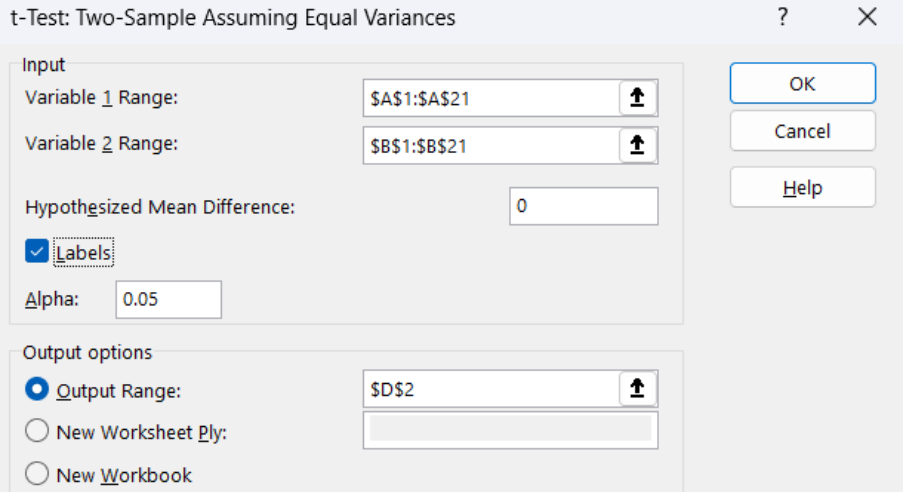
H0= Two different species of plants in a particular country have the same mean height.

H1= Two different species of plants in a particular country do not have the same mean height.

Go to Data tab > Data Analysis



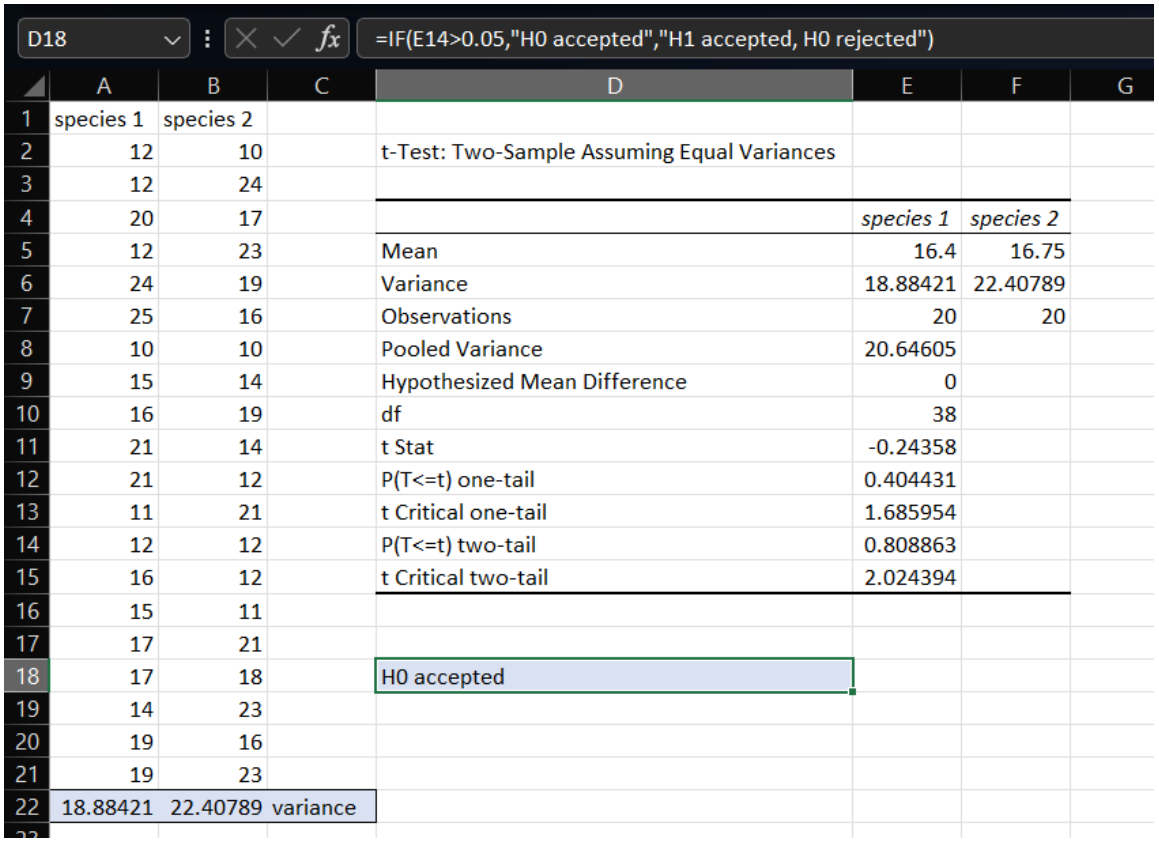

Click on OK.




Click on OK.

| t-Test: Two-Sample Assuming Equal Variances | | |
|---|---|---|
| | | |
| | *species 1* | *species 2* |
| Mean | 16.4 | 16.75 |
| Variance | 18.88421 | 22.40789 |
| Observations | 20 | 20 |
| Pooled Variance | 20.64605 | |
| Hypothesized Mean Difference | 0 | |
| df | 38 | |
| t Stat | -0.24358 | |
| P(T<=t) one-tail | 0.404431 | |
| t Critical one-tail | 1.685954 | |
| P(T<=t) two-tail | 0.808863 | |
| t Critical two-tail | 2.024394 | |

Click on D18 type =IF(E14>0.05,"H0 accepted","H1 accepted, H0 rejected")




| | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| 1 | species 1 | species 2 | | | | | |
| 2 | 12 | 10 | | t-Test: Two-Sample Assuming Equal Variances | | | |
| 3 | 12 | 24 | | | | | |
| 4 | 20 | 17 | | | *species 1* | *species 2* | |
| 5 | 12 | 23 | | Mean | 16.4 | 16.75 | |
| 6 | 24 | 19 | | Variance | 18.88421 | 22.40789 | |
| 7 | 25 | 16 | | Observations | 20 | 20 | |
| 8 | 10 | 10 | | Pooled Variance | 20.64605 | | |
| 9 | 15 | 14 | | Hypothesized Mean Difference | 0 | | |
| 10 | 16 | 19 | | df | 38 | | |
| 11 | 21 | 14 | | t Stat | -0.24358 | | |
| 12 | 21 | 12 | | P(T<=t) one-tail | 0.404431 | | |
| 13 | 11 | 21 | | t Critical one-tail | 1.685954 | | |
| 14 | 12 | 12 | | P(T<=t) two-tail | 0.808863 | | |
| 15 | 16 | 12 | | t Critical two-tail | 2.024394 | | |
| 16 | 15 | 11 | | | | | |
| 17 | 17 | 21 | | | | | |
| 18 | 17 | 18 | | H0 accepted | | | |
| 19 | 14 | 23 | | | | | |
| 20 | 19 | 16 | | | | | |
| 21 | 19 | 23 | | | | | |
| 22 | 18.88421 | 22.40789 | variance | | | | |