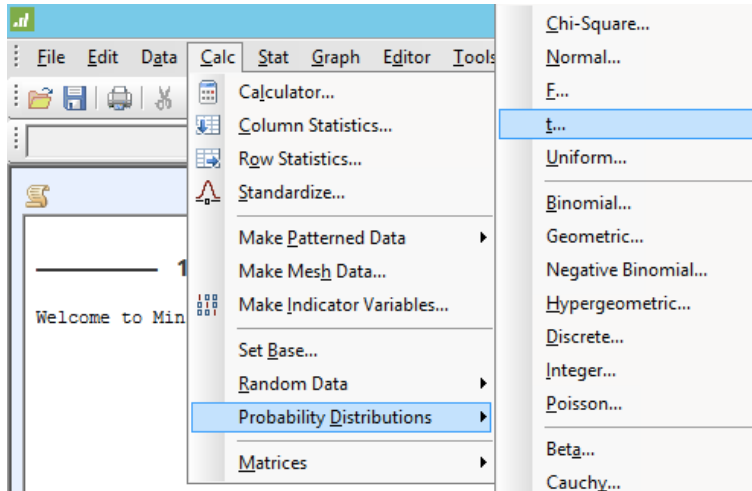


Math 155 – using Minitab to calculate P-values for t-tests.

The following procedure will give you the P-value for a *left-tailed test* with sample size n and test statistic t . Afterwards, we will discuss how to modify this procedure to obtain P-values for right-tailed tests and two-tailed tests.

Left-tailed test:

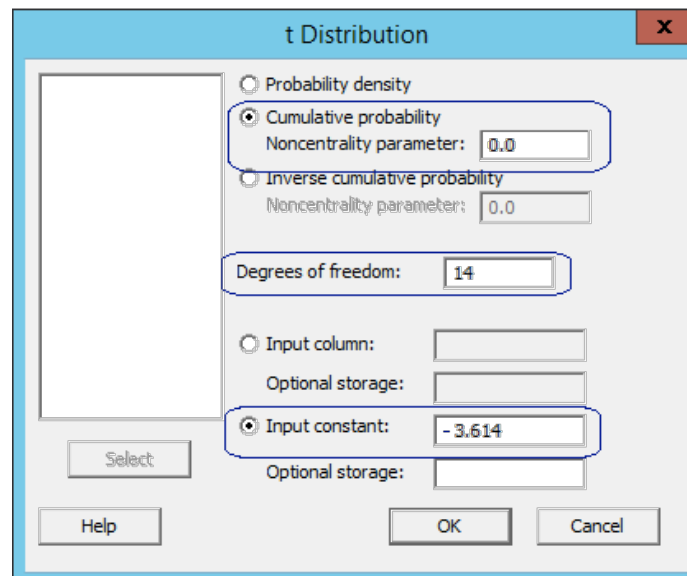
1. Select [Calc > Probability Distributions > t...]



2. In the t-distribution window, do the following:

- Select “Cumulative Probability” (leave “noncentrality parameter” as 0.0)
- Enter the degrees of freedom; remember this is one less than the sample size for a single sample. (Note: if you ever use this method for two independent samples, use one less than the smaller of the two sample sizes)
- Select “Input constant,” and enter your value of “ t ” in the box next to it.

In the diagram below, we wish to find the P-value for a left-tailed test with test statistic $t = -3.614$ and sample size $n = 15$.



3. Click “OK,” and look at the Session Window. You should see something like the following:

Cumulative Distribution Function

Student's t distribution with 14 DE

x	P(X ≤ x)
-3.614	0.0014095

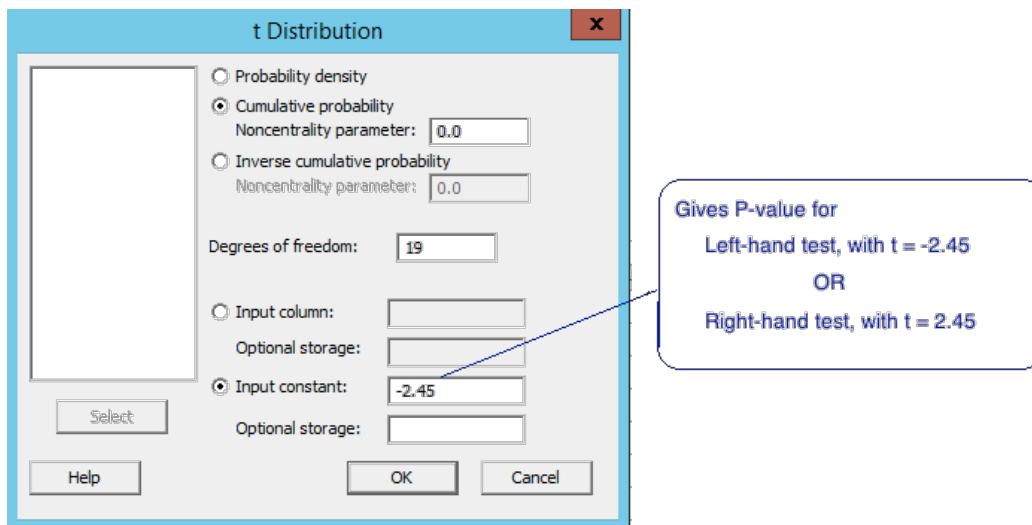
Note that $P(X \leq x)$ denotes the probability that a result would have a t-value of -3.614 or less; that is, it describes a left-tailed test. So, the test's P-value would be 0.0014095.

Again, the above instructions are for a left-tailed test. Here are the modifications to get P-values for right-tailed tests and two-tailed tests:

Right-tailed test:

Simply carry out the above instructions for a left-tailed test, but for the *opposite* of your test statistic value.

For example, if we want to find a P-value for a right-hand test with sample size $n = 20$ and test statistic $t = 2.45$, we would use Minitab to conduct a left-tailed test with $n = 20$ (meaning $20-1 = 19$ degrees of freedom) and $t = -2.45$:



Result (from Minitab): $P(X \leq x) = 0.0120744$. So, our P-value is 0.0120744.

(Note: This will take advantage of the symmetry of the t-distribution; it is similar to how we used the symmetry of the normal distribution to find probabilities earlier in the semester.)

Two-tailed test:

To find the P-value of a two-tailed test, first find the P-value of a one-tailed test (left-tailed if t is negative, or right-tailed if t is positive), and then simply *double* the result.

For example, if we wanted to find the P-value for a two-tailed test with $n=20$ and $t=2.45$, we'd carry out the instructions as shown in the diagram above, and then multiply the result by two, giving us a P-value of $2 \times 0.0120744 = 0.0241488$.