



T-DISTRIBUTION

INFERENTIAL STATISTICS

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TOPIC OUTLINE

t-Distribution



T-DISTRIBUTION



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The t-distribution (Student's t-Distribution) is used to calculate the confidence interval when:

1. The population variance (σ^2) is unknown.
2. The sample size is small ($n < 30$).

Formula:

$$CI = \bar{x} \pm t_{n-1, \alpha/2} \left(\frac{s}{\sqrt{n}} \right)$$

where:

\bar{x} = sample mean

$t_{n-1, \alpha/2}$ = t-statistic

$\frac{s}{\sqrt{n}}$ = standard error

t-table

d.f. / α	0.1	0.05	0.025	0.01	0.005
1	3.078	6.314	12.706	31.821	63.657
2	1.886	2.920	4.303	6.965	9.925
3	1.638	2.353	3.182	4.541	5.841
4	1.533	2.132	2.776	3.747	4.604
5	1.476	2.015	2.571	3.365	4.032
6	1.440	1.943	2.447	3.143	3.707
7	1.415	1.895	2.365	2.998	3.499
8	1.397	1.860	2.306	2.896	3.355
9	1.383	1.833	2.262	2.821	3.250
10	1.372	1.812	2.228	2.764	3.169
11	1.363	1.796	2.201	2.718	3.106
12	1.356	1.782	2.179	2.681	3.055
13	1.350	1.771	2.160	2.650	3.012
14	1.345	1.761	2.145	2.624	2.977
15	1.341	1.753	2.131	2.602	2.947
16	1.337	1.746	2.120	2.583	2.921
17	1.333	1.740	2.110	2.567	2.898
18	1.330	1.734	2.101	2.552	2.878
19	1.328	1.729	2.093	2.539	2.861
20	1.325	1.725	2.086	2.528	2.845
21	1.323	1.721	2.080	2.518	2.831
22	1.321	1.717	2.074	2.508	2.819
23	1.319	1.714	2.069	2.500	2.807
24	1.318	1.711	2.064	2.492	2.797
25	1.316	1.708	2.060	2.485	2.787
26	1.315	1.706	2.056	2.479	2.779
27	1.314	1.703	2.052	2.473	2.771
28	1.313	1.701	2.048	2.467	2.763
29	1.311	1.699	2.045	2.462	2.756
30	1.310	1.697	2.042	2.457	2.750
35	1.306	1.690	2.030	2.438	2.724
40	1.303	1.684	2.021	2.423	2.704
50	1.299	1.676	2.009	2.403	2.678
60	1.296	1.671	2.000	2.390	2.660
120	1.289	1.658	1.980	2.358	2.617
inf.	1.282	1.645	1.960	2.326	2.576
CI*	80%	90%	95%	98%	99%

z-statistic



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Percent Point Function

`t.ppf()` returns the critical **t** value for a given probability (1-alpha).

Two-tailed test

`t_critical = stats.t.ppf(1-alpha/2, df)`

One-tailed test

`t_critical = stats.t.ppf(1-alpha, df)`



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Interval Function

`t.interval()` returns a tuple (lower_limit, upper_limit) representing the confidence interval for t-interval.

Syntax

```
ci_lower, ci_upper = stats.t.interval(  
    confidence = confidence_level,  
    df = degrees of freedom (n-1),  
    loc = sample_mean,  
    scale = standard_error  
)
```



EXERCISE

A power company measures the voltage output (in volts) of a batch of transformers. A random sample of **10** transformers is tested, and their voltage outputs are recorded in "transformer-voltage-data-10-samples" dataset . Calculate a **95% confidence interval** for the true mean voltage output (μ) of all transformers.

Solution



LABORATORY

