

Appendix D: Values for the Percentage Points $t_{\alpha,\nu}$ of the t -Distribution

Let X_1, X_2, \dots, X_n be a random sample from a normal distribution with unknown mean μ and also unknown variance σ^2 . Then the following random variable

$$T = \frac{\bar{X} - \mu}{\frac{s}{\sqrt{n}}},$$

where

$$s^2 = \frac{\sum_{i=1}^n (X_i - \bar{X})^2}{n-1}$$

and

$$\bar{X} = \frac{1}{n} \sum_{i=1}^n X_i,$$

has a t -distribution with $n - 1$ degrees of freedom. The t probability density function is given by

$$f(x) = \frac{\Gamma[(k+1)/2]}{\sqrt{\pi k} \Gamma(k/2)} \cdot \frac{1}{[(x^2/k) + 1]^{(k+1)/2}}, \quad -\infty < x < \infty,$$

where k is the number of degrees of freedom for the underlying random variable, written as T_k , for the t -distribution. The mean and variance of the t -distribution are 0 and $k/(k-2)$ (for $k > 2$), respectively. The t -distribution is symmetrical like the standard normal distribution, is unimodal, and the mode is at 0.

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The percentage points $t_{\alpha,\nu}$ of the t -distribution are defined as follows:

$$P(T_\nu > t_{\alpha,\nu}) = \alpha.$$

Because the t -distribution is symmetrical, we have $t_{1-\alpha,\nu} = -t_{\alpha,\nu}$.

		$t_{\alpha,\nu}$					
		α	0.100	0.050	0.025	0.010	0.005
ν							
1		3.078	6.314	12.706	31.821	63.657	318.313
2		1.886	2.920	4.303	6.965	9.925	22.327
3		1.638	2.353	3.182	4.541	5.841	10.215
4		1.533	2.132	2.776	3.747	4.604	7.173
5		1.476	2.015	2.571	3.365	4.032	5.893
6		1.440	1.943	2.447	3.143	3.707	5.208
7		1.415	1.895	2.365	2.998	3.499	4.782
8		1.397	1.860	2.306	2.896	3.355	4.499
9		1.383	1.833	2.262	2.821	3.250	4.296
10		1.372	1.812	2.228	2.764	3.169	4.143
11		1.363	1.796	2.201	2.718	3.106	4.024
12		1.356	1.782	2.179	2.681	3.055	3.929
13		1.350	1.771	2.160	2.650	3.012	3.852
14		1.345	1.761	2.145	2.624	2.977	3.787
15		1.341	1.753	2.131	2.602	2.947	3.733
16		1.337	1.746	2.120	2.583	2.921	3.686
17		1.333	1.740	2.110	2.567	2.898	3.646
18		1.330	1.734	2.101	2.552	2.878	3.610
19		1.328	1.729	2.093	2.539	2.861	3.579
20		1.325	1.725	2.086	2.528	2.845	3.552
21		1.323	1.721	2.080	2.518	2.831	3.527
22		1.321	1.717	2.074	2.508	2.819	3.505
23		1.319	1.714	2.069	2.500	2.807	3.485
24		1.318	1.711	2.064	2.492	2.797	3.467
25		1.316	1.708	2.060	2.485	2.787	3.450
26		1.315	1.706	2.056	2.479	2.779	3.435
27		1.314	1.703	2.052	2.473	2.771	3.421
28		1.313	1.701	2.048	2.467	2.763	3.408
29		1.311	1.699	2.045	2.462	2.756	3.396
30		1.310	1.697	2.042	2.457	2.750	3.385
31		1.309	1.696	2.040	2.453	2.744	3.375
32		1.309	1.694	2.037	2.449	2.738	3.365
33		1.308	1.692	2.035	2.445	2.733	3.356
34		1.307	1.691	2.032	2.441	2.728	3.348
35		1.306	1.690	2.030	2.438	2.724	3.340
36		1.306	1.688	2.028	2.434	2.719	3.333
37		1.305	1.687	2.026	2.431	2.715	3.326
38		1.304	1.686	2.024	2.429	2.712	3.319
39		1.304	1.685	2.023	2.426	2.708	3.313
40		1.303	1.684	2.021	2.423	2.704	3.307
41		1.303	1.683	2.020	2.421	2.701	3.301
42		1.302	1.682	2.018	2.418	2.698	3.296

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		$t_{\alpha,\nu}$					
$\nu \backslash \alpha$	0.100	0.050	0.025	0.010	0.005	0.001	
43	1.302	1.681	2.017	2.416	2.695	3.291	
44	1.301	1.680	2.015	2.414	2.692	3.286	
45	1.301	1.679	2.014	2.412	2.690	3.281	
46	1.300	1.679	2.013	2.410	2.687	3.277	
47	1.300	1.678	2.012	2.408	2.685	3.273	
48	1.299	1.677	2.011	2.407	2.682	3.269	
49	1.299	1.677	2.010	2.405	2.680	3.265	
50	1.299	1.676	2.009	2.403	2.678	3.261	
51	1.298	1.675	2.008	2.402	2.676	3.258	
52	1.298	1.675	2.007	2.400	2.674	3.255	
53	1.298	1.674	2.006	2.399	2.672	3.251	
54	1.297	1.674	2.005	2.397	2.670	3.248	
55	1.297	1.673	2.004	2.396	2.668	3.245	
56	1.297	1.673	2.003	2.395	2.667	3.242	
57	1.297	1.672	2.002	2.394	2.665	3.239	
58	1.296	1.672	2.002	2.392	2.663	3.237	
59	1.296	1.671	2.001	2.391	2.662	3.234	
60	1.296	1.671	2.000	2.390	2.660	3.232	
61	1.296	1.670	2.000	2.389	2.659	3.229	
62	1.295	1.670	1.999	2.388	2.657	3.227	
63	1.295	1.669	1.998	2.387	2.656	3.225	
64	1.295	1.669	1.998	2.386	2.655	3.223	
65	1.295	1.669	1.997	2.385	2.654	3.220	
66	1.295	1.668	1.997	2.384	2.652	3.218	
67	1.294	1.668	1.996	2.383	2.651	3.216	
68	1.294	1.668	1.995	2.382	2.650	3.214	
69	1.294	1.667	1.995	2.382	2.649	3.213	
70	1.294	1.667	1.994	2.381	2.648	3.211	
71	1.294	1.667	1.994	2.380	2.647	3.209	
72	1.293	1.666	1.993	2.379	2.646	3.207	
73	1.293	1.666	1.993	2.379	2.645	3.206	
74	1.293	1.666	1.993	2.378	2.644	3.204	
75	1.293	1.665	1.992	2.377	2.643	3.202	
76	1.293	1.665	1.992	2.376	2.642	3.201	
77	1.293	1.665	1.991	2.376	2.641	3.199	
78	1.292	1.665	1.991	2.375	2.640	3.198	
79	1.292	1.664	1.990	2.374	2.640	3.197	
80	1.292	1.664	1.990	2.374	2.639	3.195	
81	1.292	1.664	1.990	2.373	2.638	3.194	
82	1.292	1.664	1.989	2.373	2.637	3.193	
83	1.292	1.663	1.989	2.372	2.636	3.191	
84	1.292	1.663	1.989	2.372	2.636	3.190	
85	1.292	1.663	1.988	2.371	2.635	3.189	
86	1.291	1.663	1.988	2.370	2.634	3.188	
87	1.291	1.663	1.988	2.370	2.634	3.187	
88	1.291	1.662	1.987	2.369	2.633	3.185	
89	1.291	1.662	1.987	2.369	2.632	3.184	
90	1.291	1.662	1.987	2.368	2.632	3.183	
∞	1.282	1.645	1.960	2.326	2.576	3.090	