AMAT 108 Elementary Statistics — Exam 3
Spring 2025 — Version 1

Answer Key

Directions: You have **80 minutes** to answer the following questions. ***No notes, textbooks, mobile phones or other aids are allowed. Only scientific calculators are allowed.*** For all multiple-choice questions, select **one** answer from among the choices given. No explanation is required to be shown and no partial credit will be given. Make sure to **completely** fill in the circle corresponding to your chosen answer. For all free-response questions, you **must** show all necessary work to receive full credit. An answer with no work, even if correct, will not receive full credit. Please circle or box your final answer. All work, if needed, is to be rounded to ***five*** decimal places.

Do not detach any pages. Please choose your section with a check mark (✓) in the left-most column.

✓	Instructor Name	Meeting Time	Meeting Days	Meeting Location	Section
	John Habib	11:40AM	M/W	HU 124	1651
	Seth Hulbert	09:00AM	T/TH	SS 116	3998
		12:00PM		HU 124	4046
	Tung Lam	09:00AM	T/TH	FA 126	6998
		01:30PM		TA 118	2761
	James Lamatina	01:10PM	M/W	LC 2	1648
		03:00PM		LC 25	3402
		09:00AM	T/TH	LC 3B	3209
	Chris Lange	03:00PM	T/TH	SS 255	1649
		04:30PM			1653
	Douglas Rosenberg	03:00PM	M/W	BB B006	1652
		04:30PM		HU 133	1654
	Sam Spellman	01:10PM	M/W	FA 126	1650
	Alea Wittig	10:30AM	T/TH	HU 123	3382
		12:00PM		HU 129	3399
	Peter Young	08:00AM	M/W	SS 255	3508
		11:40AM		HU 123	3406

Exam Scoring:

Page	Possible Points	Points Earned
3	4	
4	13	
5	8	
6	11	
7	9	
Total Points	45	

Percentage	

1. The null hypothesis of a statistical test is as follows:

$$H_0\text{: The average lifespan of an LED light bulb is 4.315 years.}$$

Which of the following leads to a Type 1 error (false-positive)? (1 pt.)

① We fail to reject H_0 when the average lifespan of LED light bulbs is 4.315 years.

② We reject H_0 when the average lifespan of LED light bulbs is 4.315 years.

③ We fail to reject H_0 when the average lifespan of LED light bulbs is not 4.315 years.

④ We reject H_0 when the average lifespan of LED light bulbs is not 4.315 years.

2. Which of the following is true about the relationship between claims and statistical hypotheses? (1 pt.)

① Only claims about population characteristics are valid as statistical hypotheses.

② Only claims about sample characteristics are valid as statistical hypotheses.

③ Any claim about any characteristic can be valid as a statistical hypothesis.

④ None of the above are true.

Questions 3 and 4 are based on the following: Suppose $n = 29$ and the conditions for the confidence intervals for p and μ are met.

3. Which of the following is the 96% z^* critical number? (1 pt.)

① 2.150

② 2.286

③ 2.048

④ 2.154

⑤ 2.054

4. Which of the following is an appropriate 96% t^* critical number? (1 pt.)

① 2.150

② 2.286

③ 2.048

④ 2.154

⑤ 2.054

5. Professor Hulbert notices that the University IT staff is regularly replacing WiFi routers. Concerned that a manufacturing defect in the routers is the problem, he observes the number of times that at least one WiFi router is replaced over 75 randomly selected days. Professor Hulbert finds that at least one WiFi router is replaced in 74% of the observed days.

   (a) Show that the success-failure conditions for the Large-Sample Confidence Interval for p are met. (4 pts.) The success condition is

$$n\hat{p} = 75(.74) \tag{1}$$
$$= 55.5 \tag{2}$$

and the failure condition is

$$n(1-\hat{p}) = 75(1-.74) \tag{3}$$
$$= 19.5 \tag{4}$$

- $\boxed{+1}$ each for (1) - (4)

   (b) Construct a 98% confidence interval for the population proportion, p, of days that at least one WiFi router is replaced. Round *both* endpoints to *three* decimal places. (6 pts.)

$$\text{CI} = .74 \pm 2.326\sqrt{\frac{.74(1-.74)}{75}} \tag{5}$$
$$= \left(.74 - 2.326\sqrt{\frac{.74(1-.74)}{75}}, .74 + 2.326\sqrt{\frac{.74(1-.74)}{75}}\right) \tag{6}$$
$$\approx \left(.74 - 2.326\sqrt{.00257}, .74 + 2.326\sqrt{.00257}\right) \tag{7}$$
$$\approx (.74 - 2.326(.05070), .74 + 2.326(.05070)) \tag{8}$$
$$\approx (.74 - .11793, .74 + .11793) \tag{9}$$
$$\approx (0.622, 0.858) \tag{10}$$

- $\boxed{+1}$ for point estimate of 0.74
- $\boxed{+1}$ for $z^* \approx 2.326$
- $\boxed{+1}$ for fraction inside square root (no partial credit)
- $\boxed{+1}$ for taking square root of fraction
- $\boxed{+2}$ for (10) (one point for each endpoint)

Note. If the student gives $(0.858, 0.622)$ as their answer, deduct one point.

   (c) Find the conservatively large sample size required to estimate the proportion of days that at least one WiFi router is replaced to within 0.008 with 98% confidence. Round your answer *up* to the nearest whole number. (3 pts.)

$$n = \frac{1}{4}\left(\frac{2.326}{.008}\right)^2 \tag{11}$$
$$\approx 21133.891 \tag{12}$$
$$\uparrow 21134 \tag{13}$$

- $\boxed{+1}$ for fraction inside of parentheses being squared (no partial credit)
- $\boxed{+1}$ for multiplying squared fraction by one-fourth (.25 is acceptable)
- $\boxed{+1}$ for (13)

6. The Math Department at SUNY Albany is concerned about the number of black Expo markers its instructors use per semester. To investigate this further, Professor Habib randomly selects 593 black Expo markers and records the number of lectures each marker lasts. The sample he collects has an average of 9.053 lectures and a standard deviation of 2.194 lectures.
   (a) Are all requirements for the confidence interval for μ met? (1 pt.)

   ① Yes, because the population of interest has a normal distribution.

   ② Yes, because the collected sample has a normal distribution.

   ③ Yes, because the collected sample is sufficiently large.

   ④ No, because none of the above apply.

   (b) Construct a central 97% confidence interval for the population mean, μ, lifespan of black Expo markers in number of lectures. Use $t^* \approx 2.175$ as your appropriate 97% t^* critical number. Round *both* endpoints to *three* decimal places. (6 pts.)

$$\text{CI} = 9.053 \pm 2.175\left(\frac{2.194}{\sqrt{593}}\right) \tag{14}$$

$$= \left(9.053 - 2.175\left(\frac{2.194}{\sqrt{593}}\right), 9.053 + 2.175\left(\frac{2.194}{\sqrt{593}}\right)\right) \tag{15}$$

$$\approx (9.053 - 2.175(0.09010), 9.053 + 2.175(0.09010)) \tag{16}$$

$$\approx (9.053 - 0.19597, 9.053 + 0.19597) \tag{17}$$

$$\approx (8.857, 9.249) \tag{18}$$

   - $\boxed{+1}$ for point estimate of 9.053
   - $\boxed{+1}$ for using given $t^* \approx 2.175$
   - $\boxed{+1}$ for numerator of standard error fraction as 2.194
   - $\boxed{+1}$ for denominator of standard error fraction as $\sqrt{593}$ (no partial credit)
   - $\boxed{+2}$ for (18) (one point for each endpoint)

   Note.
   - Some students may use $z^* \approx 2.170$ as their critical number and obtain the same answer. One point should be deducted because the appropriate critical number is given to them.
   - If the student gives $(9.249, 8.857)$ as their answer, deduct one point.

   (c) Which of the following is the correct interpretation of the interval constructed in (b) above? (1 pt.)

   ① The probability that the actual value of μ is within the constructed interval is equal to 97%.

   ② We are 97% confident that the actual value of μ is within the constructed interval.

   ③ Both of the above answers are true.

   ④ None of the above answers are true.

7. A recently-published report claims that 43% of American drivers fill their gas tank at least once every week. Thinking this claim is an underestimate, Professor Rosenberg follows the driving habits of 9306 randomly-selected American drivers. He finds that 4164 of the selected American drivers fill their gas tank at least once every week. Professor Rosenberg wishes to know if he has enough evidence to conclude that the claim is an underestimate.

   (a) Select the correct pair of statistical hypotheses. (1 pt.)

   ① H_0: $p = 0.43$ vs. H_1: $p < 0.43$

   ② H_0: $p = 0.43$ vs. H_1: $p > 0.43$

   ③ H_0: $p = 0.43$ vs. H_1: $p \neq 0.43$

   (b) Compute the sample proportion. Round your answer to *five* decimal places. (3 pts.)

$$\hat{p} = \frac{4164}{9306} \tag{19}$$

$$\approx 0.44745 \ \boxed{+1} \tag{20}$$

   - $\boxed{+2}$ for (19) (one point for numerator and one point for denominator)

   (c) Use your answer in (b) to compute the z^* test statistic. Round your answer to *two* decimal places, where appropriate. (3 pts.)

$$z^* = \frac{.44745 - .43}{\sqrt{\frac{.43(1-.43)}{9306}}} \tag{21}$$

$$\approx 3.40^{***} \tag{22}$$

   - $\boxed{+1}$ for numerator in (21)
   - $\boxed{+1}$ for denominator in (21) including square root and fraction (no partial credit)
   - $\boxed{+1}$ for (22) with correct rounding

   (d) Use your answer in (c) to compute the *p-value* of the test. Round your answer to *four* decimal places. (3 pts.)

(23) $\alpha_0 = P_{H_0}(Z \geq 3.40)$ $\qquad$ $\alpha_0 = P_{H_0}(Z \geq 3.40)$

(24) $= 1 - P_{H_0}(Z \leq 3.40) \approx 1 - .9997$ $\qquad$ $= P_{H_0}(Z \leq -3.40)$

(25) $= .0003$ $\qquad$ ≈ 0.0003

   - $\boxed{+1}$ each for (23), (24), and (25) (does not matter which side student shows)

   (e) Which of the following is the correct conclusion? (1 pt.)

   ① Fail to reject H_0 at $\alpha = 0.05$. Professor Rosenberg does not have enough evidence to conclude that the claim is an underestimate.

   ② Reject H_0 at $\alpha = 0.05$, but fail to reject H_0 at $\alpha = 0.01$. Professor Rosenberg has a slight amount of evidence to conclude that the claim is an underestimate.

   ③ Reject H_0 at $\alpha = 0.01$, but fail to reject H_0 at $\alpha = 0.001$. Professor Rosenberg has a convincing amount of evidence to conclude that the claim is an underestimate.

   ④ Reject H_0 at $\alpha = 0.001$. Professor Rosenberg has an overwhelming amount of evidence to conclude that the claim is an underestimate.

8. Professor Wittig claims that a Scottish Fold cat eats 4 pounds of wet food every week. Professor Lam and Professor Spellman, however, believe Professor Wittig is incorrect about her claim. To determine who's right, the three select 81 Scottish Fold cats at random and measure the amount of wet food they eat in a given week. They find that the 81 Scottish Fold cats eat an average of 3.506 pounds of wet food, with a standard deviation of 1.073 pounds. The three professors wish to know if there is enough evidence to conclude that Professor Wittig's claim is incorrect.

(a) Select the correct pair of statistical hypotheses. (1 pt.)

① H_0: $\mu = 4$ vs. H_1: $\mu < 4$

② H_0: $\mu = 4$ vs. H_1: $\mu > 4$

③ H_0: $\mu = 4$ vs. H_1: $\mu \neq 4$

(b) Compute the t^* test statistic. Round your answer to *one* decimal place. (3 pts.)

$$t^* = \frac{3.506 - 4}{\left(\frac{1.073}{\sqrt{81}}\right)} \tag{26}$$

$$\approx -4.1^{***} \quad \boxed{+1} \tag{27}$$

- $\boxed{+1}$ for numerator in (26)
- $\boxed{+1}$ for denominator in (26) including square root and fraction (no partial credit)

(c) The test statistic has a t distribution with how many degrees of freedom? (1 pt.)

① 79 ② 80 ③ 82 ④ 81

(d) Compute the *p-value* of the test. Round your answer to *three* decimal places. (3 pts.)

$$\alpha_0 = 2P_{H_0}(T \leq -4.1) \tag{28}$$

$$= 2P_{H_0}(T \geq 4.1) \tag{29}$$

$$\approx 2(0) \tag{30}$$

$$= 0. \tag{31}$$

- $\boxed{+1}$ for multiplier of 2 in front of probability, as shown in (28) - (30)
- $\boxed{+1}$ for recognizing that either tail area needs to be found, as in (28) or (29)
- $\boxed{+1}$ for (31)

(e) Which of the following is the correct conclusion? (1 pt.)

① Fail to reject H_0 at $\alpha = 0.05$. There is not enough evidence to conclude that Professor Wittig's claim is incorrect.

② Reject H_0 at $\alpha = 0.05$, but fail to reject H_0 at $\alpha = 0.01$. There is a slight amount of evidence to conclude that Professor Wittig's claim is incorrect.

③ Reject H_0 at $\alpha = 0.01$, but fail to reject H_0 at $\alpha = 0.001$. There is a convincing amount of evidence to conclude that Professor Wittig's claim is incorrect.

④ Reject H_0 at $\alpha = 0.001$. There is an overwhelming amount of evidence to conclude that Professor Wittig's claim is incorrect.

Formula Sheet:

- Sample proportion:

$$\hat{p} = \frac{\text{number of successes in sample}}{n}$$

- Confidence interval for a population proportion:

$$\hat{p} \pm z^* \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

- Success/failure condition for the confidence interval for a population proportion:

$$n\hat{p} \geq 10 \qquad\qquad n(1-\hat{p}) \geq 10$$

- Determining the sample size required to be within M = margin of error under a certain confidence level:

$$n = p(1-p)\left(\frac{z^*}{M}\right)^2$$

- To find the conservatively large sample size required, set $p = 0.5$.

- Confidence interval for a population mean (when σ unknown):

$$\overline{x} \pm t^*\left(\frac{s}{\sqrt{n}}\right) \qquad\qquad df = n-1$$

- z-test statistic for hypothesis testing of a population proportion:

$$z^* = \frac{\hat{p} - p_0}{\sqrt{\frac{p(1-p)}{n}}}$$

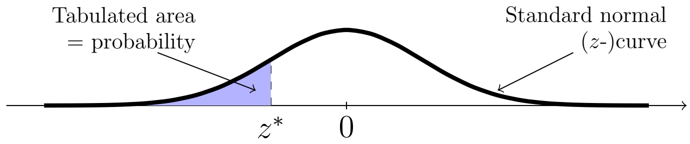
- Success/failure condition for the sampling distribution of $\hat{p}$ to be approximately normal:

$$np_0 \geq 10 \qquad\qquad n(1-p_0) \geq 10$$

- t-test statistic for hypothesis testing of a population mean (when σ unknown):

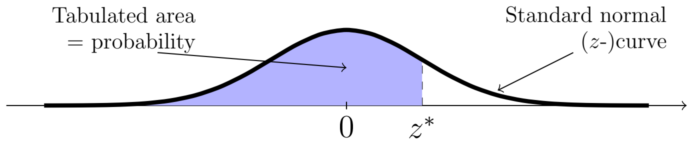
$$t^* = \frac{\overline{x} - \mu_0}{\left(\frac{s}{\sqrt{n}}\right)} \qquad\qquad df = n-1$$

Standard Normal Table



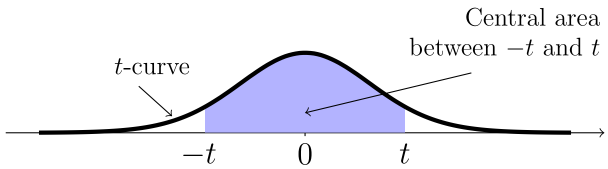
z^*	**0.00**	**0.01**	**0.02**	**0.03**	**0.04**	**0.05**	**0.06**	**0.07**	**0.08**	**0.09**
-3.9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
-3.8	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
-3.7	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
-3.6	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
-3.5	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
-3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
-3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
-3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
-3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
-3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
-2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
-2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
-2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
-2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
-2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
-2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
-2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
-2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
-2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
-2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
-1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
-1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
-1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
-1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
-1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
-1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
-1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
-1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
-1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
-1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
-0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
-0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
-0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
-0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
-0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
-0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
-0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
-0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
-0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
-0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641

Standard Normal Table



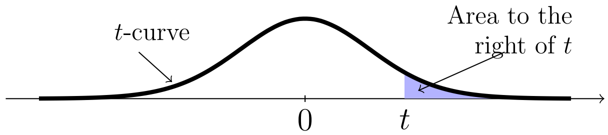
z^*	**0.00**	**0.01**	**0.02**	**0.03**	**0.04**	**0.05**	**0.06**	**0.07**	**0.08**	**0.09**
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998
3.5	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998
3.6	0.9998	0.9998	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.7	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.8	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.9	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

t-Distribution Table of Critical Values



degree of freedom	Central Area Captured / Confidence Level 80%	90%	95%	96%	97%	98%	99%	99.8%	99.9%
1	3.078	6.314	12.706	15.895	21.205	31.821	63.657	318.309	636.619
2	1.886	2.920	4.303	4.849	5.643	6.965	9.925	22.327	31.599
3	1.638	2.353	3.182	3.482	3.896	4.541	5.841	10.215	12.924
4	1.533	2.132	2.776	2.999	3.298	3.747	4.604	7.173	8.610
5	1.476	2.015	2.571	2.757	3.003	3.365	4.032	5.893	6.869
6	1.440	1.943	2.447	2.612	2.829	3.143	3.707	5.208	5.959
7	1.415	1.895	2.365	2.517	2.715	2.998	3.499	4.785	5.408
8	1.397	1.860	2.306	2.449	2.634	2.896	3.355	4.501	5.041
9	1.383	1.833	2.262	2.398	2.574	2.821	3.250	4.297	4.781
10	1.372	1.812	2.228	2.359	2.527	2.764	3.169	4.144	4.587
11	1.363	1.796	2.201	2.328	2.491	2.718	3.106	4.025	4.437
12	1.356	1.782	2.179	2.303	2.461	2.681	3.055	3.930	4.318
13	1.350	1.771	2.160	2.282	2.436	2.650	3.012	3.852	4.221
14	1.345	1.761	2.145	2.264	2.415	2.624	2.977	3.787	4.140
15	1.341	1.753	2.131	2.249	2.397	2.602	2.947	3.733	4.073
16	1.337	1.746	2.120	2.235	2.382	2.583	2.921	3.686	4.015
17	1.333	1.740	2.110	2.224	2.368	2.567	2.898	3.646	3.965
18	1.330	1.734	2.101	2.214	2.356	2.552	2.878	3.610	3.922
19	1.328	1.729	2.093	2.205	2.346	2.539	2.861	3.579	3.883
20	1.325	1.725	2.086	2.197	2.336	2.528	2.845	3.552	3.850
21	1.323	1.721	2.080	2.189	2.328	2.518	2.831	3.527	3.819
22	1.321	1.717	2.074	2.183	2.320	2.508	2.819	3.505	3.792
23	1.319	1.714	2.069	2.177	2.313	2.500	2.807	3.485	3.768
24	1.318	1.711	2.064	2.172	2.307	2.492	2.797	3.467	3.745
25	1.316	1.708	2.060	2.167	2.301	2.485	2.787	3.450	3.725
26	1.315	1.706	2.056	2.162	2.296	2.479	2.779	3.435	3.707
27	1.314	1.703	2.052	2.158	2.291	2.473	2.771	3.421	3.690
28	1.313	1.701	2.048	2.154	2.286	2.467	2.763	3.408	3.674
29	1.311	1.699	2.045	2.150	2.282	2.462	2.756	3.396	3.659
30	1.310	1.697	2.042	2.147	2.278	2.457	2.750	3.385	3.646
40	1.303	1.684	2.021	2.123	2.250	2.423	2.704	3.307	3.551
50	1.299	1.676	2.009	2.109	2.234	2.403	2.678	3.261	3.496
60	1.296	1.671	2.000	2.099	2.223	2.390	2.660	3.232	3.460
70	1.294	1.667	1.994	2.093	2.215	2.381	2.648	3.211	3.435
80	1.292	1.664	1.990	2.088	2.209	2.374	2.639	3.195	3.416
90	1.291	1.662	1.987	2.084	2.205	2.368	2.632	3.183	3.402
100	1.290	1.660	1.984	2.081	2.201	2.364	2.626	3.174	3.390
110	1.289	1.659	1.982	2.078	2.199	2.361	2.621	3.166	3.381
120	1.289	1.658	1.980	2.076	2.196	2.358	2.617	3.160	3.373
z-critical = ∞	1.282	1.645	1.960	2.054	2.170	2.326	2.576	3.090	3.291

Tail Areas for t Curves



t^* \ df	**1**	**2**	**3**	**4**	**...**	**80**	**90**	**100**	**110**	**120**
0.0	0.500	0.500	0.500	0.500	...	0.500	0.500	0.500	0.500	0.500
0.1	0.468	0.465	0.463	0.463	...	0.460	0.460	0.460	0.460	0.460
0.2	0.437	0.430	0.427	0.426	...	0.421	0.421	0.421	0.421	0.421
0.3	0.407	0.396	0.392	0.390	...	0.382	0.382	0.382	0.382	0.382
0.4	0.379	0.364	0.358	0.355	...	0.345	0.345	0.345	0.345	0.345
0.5	0.352	0.333	0.326	0.322	...	0.309	0.309	0.309	0.309	0.309
0.6	0.328	0.305	0.295	0.290	...	0.275	0.275	0.275	0.275	0.275
0.7	0.306	0.278	0.267	0.261	...	0.243	0.243	0.243	0.243	0.243
0.8	0.285	0.254	0.241	0.234	...	0.213	0.213	0.213	0.213	0.213
0.9	0.267	0.232	0.217	0.210	...	0.185	0.185	0.185	0.185	0.185
1.0	0.250	0.211	0.196	0.187	...	0.160	0.160	0.160	0.160	0.160
1.1	0.235	0.193	0.176	0.167	...	0.137	0.137	0.137	0.137	0.137
1.2	0.221	0.177	0.158	0.148	...	0.117	0.117	0.116	0.116	0.116
1.3	0.209	0.162	0.142	0.132	...	0.099	0.098	0.098	0.098	0.098
1.4	0.197	0.148	0.128	0.117	...	0.083	0.082	0.082	0.082	0.082
1.5	0.187	0.136	0.115	0.104	...	0.069	0.069	0.068	0.068	0.068
1.6	0.178	0.125	0.104	0.092	...	0.057	0.057	0.056	0.056	0.056
1.7	0.169	0.116	0.094	0.082	...	0.047	0.046	0.046	0.046	0.046
1.8	0.161	0.107	0.085	0.073	...	0.038	0.038	0.037	0.037	0.037
1.9	0.154	0.099	0.077	0.065	...	0.031	0.030	0.030	0.030	0.030
2.0	0.148	0.092	0.070	0.058	...	0.024	0.024	0.024	0.024	0.024
2.1	0.141	0.085	0.063	0.052	...	0.019	0.019	0.019	0.019	0.019
2.2	0.136	0.079	0.058	0.046	...	0.015	0.015	0.015	0.015	0.015
2.3	0.131	0.074	0.052	0.041	...	0.012	0.012	0.012	0.012	0.012
2.4	0.126	0.069	0.048	0.037	...	0.009	0.009	0.009	0.009	0.009
2.5	0.121	0.065	0.044	0.033	...	0.007	0.007	0.007	0.007	0.007
2.6	0.117	0.061	0.040	0.030	...	0.006	0.005	0.005	0.005	0.005
2.7	0.113	0.057	0.037	0.027	...	0.004	0.004	0.004	0.004	0.004
2.8	0.109	0.054	0.034	0.024	...	0.003	0.003	0.003	0.003	0.003
2.9	0.106	0.051	0.031	0.022	...	0.002	0.002	0.002	0.002	0.002
3.0	0.102	0.048	0.029	0.020	...	0.002	0.002	0.002	0.002	0.002
3.1	0.099	0.045	0.027	0.018	...	0.001	0.001	0.001	0.001	0.001
3.2	0.096	0.043	0.025	0.016	...	0.001	0.001	0.001	0.001	0.001
3.3	0.094	0.040	0.023	0.015	...	0.001	0.001	0.001	0.001	0.001
3.4	0.091	0.038	0.021	0.014	...	0.001	0.001	0.000	0.000	0.000
3.5	0.089	0.036	0.020	0.012	...	0.000	0.000	0.000	0.000	0.000
3.6	0.086	0.035	0.018	0.011	...	0.000	0.000	0.000	0.000	0.000
3.7	0.084	0.033	0.017	0.010	...	0.000	0.000	0.000	0.000	0.000
3.8	0.082	0.031	0.016	0.010	...	0.000	0.000	0.000	0.000	0.000
3.9	0.080	0.030	0.015	0.009	...	0.000	0.000	0.000	0.000	0.000
4.0	0.078	0.029	0.014	0.008	...	0.000	0.000	0.000	0.000	0.000
4.1	0.076	0.027	0.013	0.007	...	0.000	0.000	0.000	0.000	0.000
4.2	0.074	0.026	0.012	0.007	...	0.000	0.000	0.000	0.000	0.000
4.3	0.073	0.025	0.012	0.006	...	0.000	0.000	0.000	0.000	0.000