

UNIVERSITI KUALA LUMPUR  
BUSINESS SCHOOL

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**FINAL EXAMINATION**  
**OCTOBER 2025 SEMESTER**

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COURSE CODE : EIB11103  
COURSE TITLE : BUSINESS STATISTICS  
PROGRAMME NAME : BACHELOR OF SCIENCE (HONS) IN ANALYTICAL ECONOMICS  
DATE : 24 JANUARY 2026  
TIME : 02:00PM - 05:00PM  
DURATION : 3 HOURS

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**INSTRUCTIONS TO CANDIDATES**

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1. Please read the instructions given in the question paper CAREFULLY.
2. This question paper is printed on both sides of the paper.
3. This question paper consist of ONE sections.
4. Section A consist of five questions. Answer FOUR (4) questions only.
5. Please write your answer on the answer booklet provided.
6. Please answer all questions in English only.
7. Refer to the attached Formula/ Appendies.  Tick if applicable

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THERE ARE 11 PAGES OF QUESTIONS INCLUDING THIS PAGE

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**SECTION A (Total: 100 marks)**

Answer FOUR (4) questions.

Please use the answer booklet provided.

**Question 1**

Answer all questions below.

- (a) A digital marketing analytics team observes that the time between consecutive clicks on a newly launched online advertisement follows an exponential distribution and based on the first week of campaign data they estimate that the average time between clicks is 7.5 minutes.
- i. Find the likelihood that the next click will occur in less than 5 minutes.  
(3 marks)
- ii. Find the likelihood that the next click will occur in more than 6.5 minutes.  
(3 marks)
- (b) A human resource manager wants to estimate the average number of tasks completed per day by employees in a department. Assume the population is normally distributed and the population standard deviation is known to be 6 tasks. A random sample of 64 employees shows a sample mean of 42 tasks per day. What is the probability that the sample mean will fall within  $\pm 2$  tasks of the population mean?  
(4 marks)
- (c) A global retail company surveys 40 customers in Europe to estimate the average monthly spending on imported products. The sample mean is USD 220 with a standard deviation of USD 30. Construct a 95% confidence interval for the population mean spending. Interpret your result.  
(5 marks)

- (d) A company wants to test whether the average monthly spending on digital advertisements is RM5,000. A random sample of 25 months shows a monthly spending of RM5,350 with a sample standard deviation of RM450. Test at the 1% significance level whether the average spending differs from RM5,000.

(5 marks)

- (e) An Islamic finance institution wants to study the effect of amount of financing provided (X, in RM thousands) on the profit earned (Y, in RM thousands) by SMEs under Murabaha contracts. A sample of 5 SMEs yields the following data in the table shown below. Find the least squares regression line.

*Refer Below - Figure1 : . .*

(5 marks)

Financing	Profit
80	10.0
60	8.1
55	7.8
70	9.2
65	8.7

Figure 1: .

**Question 2**

Answer all questions below.

- (a) Average occupancy duration at an international hotel is normally distributed with a mean of 4.3 nights and a standard deviation of 1.1 nights. Find the probability that a randomly chosen guest stays more than 6 nights.  
(3 marks)
- (b) A manufacturing manager states that 12% of all units produced fail to meet quality standards. Assume that the information follows a normal distribution. If a random sample of 200 units is selected:
- Find the standard error of the sample proportion.  
(3 marks)
  - Find the probability that the sample proportion more than 15% will be defective.  
(3 marks)
- (c) A multinational corporation surveys 250 customers in Europe and 200 customers in Asia regarding satisfaction with international shipping. Among the sample size given, 190 European customers and 150 Asian customers report their satisfaction.
- Calculate a 99% confidence interval for the difference in satisfaction population proportions between Europe and Asia.  
(5 marks)
  - Interpret the results.  
(2 marks)
- (d) A marketing director claims that the average engagement time on a new mobile app exceeds 10 minutes. A sample of 60 users shows a mean of 10.8 minutes, with a population standard deviation of 1.5 minutes. Test at the 5% significance level whether the claim is valid on a new mobile app exceed 10 minutes.  
(5 marks)

- (e) An Islamic bank collects data on customer age ( $X$ ) and monthly deposit amount ( $Y$ ). All sample data are shown in the table below. Calculate the correlation coefficient.

*Refer Below - Figure2 : . .*

(4 marks)

Age	Deposit (RM)
25	500
30	600
35	550
28	900
33	850

Figure 2: .

**Question 3**

Answer all questions below.

- (a) Average occupancy duration at an international hotel is normally distributed with a mean of 4.3 nights and a standard deviation of 1.1 nights. Find the probability that a randomly chosen guest stays less than 3 nights.

(3 marks)

- (b) A management consulting firm conducts a large customer satisfaction study where the population satisfaction score has a mean of 78 and a known standard deviation of 10. Assume that the information follows a normal distribution. If the sample of 50 customers is selected at random. Find the probability that the sample mean will be less than 75.

(3 marks)

- (c) A global company surveys 150 employees in the US and 180 employees in the Germany on working mode. 105 US employees and 130 German employees prefer hybrid work. Using a 90% confidence interval for the difference in proportions between US employees and Germany employees. Interpret the results.

(6 marks)

- (d) A marketing manager wants to compare the monthly spending on promotional products between Region X and Region Y. Table below shows the details for these two regions. At the 0.05 significance level, test whether the average spending differs between the two regions by showing all the steps in hypothesis testing.

*Refer Below - Figure 3 : . . .*

(7 marks)

	Region X	Region Y
$n$	30	35
$\bar{x}$	RM6,200	RM6,050
$\sigma$	500	480

Figure 3: .

- (e) An Islamic bank wants to examine the effect of financing amount ( $X$ , in RM thousands) on customer satisfaction scores ( $Y$ , out of 10) for Murabaha products.

Data are shown in the table:

Refer Below - Figure 4 : . .

Financing	Satisfaction
50	7.0
60	7.5
55	7.2
70	8.0
65	7.8

Figure 4: .

- i. Find the linear regression equation. (5 marks)
- ii. Predict satisfaction for a financing amount of RM68,000. (1 marks)

**Question 4**

Answer all questions below.

- (a) In a large company's marketing division, analysts monitor the arrival of customer inquiries through the live chat system and have determined that the time between inquiries can be modeled using an exponential distribution with a rate of 0.18 inquiries per minute. Compute the likelihood that the next inquiry will take more than 12 minutes to arrive. (3 marks)
- (b) A management consulting firm conducts a large customer satisfaction study where the population satisfaction score has a mean of 78 and a known standard deviation of 10. Assume that the information follows a normal distribution. If the sample of 50 customers is selected at random. Find the probability that the sample mean will be more than 80. (3 marks)
- (c) A global company surveys 150 employees in the US and 180 employees in the Germany on working mode. 105 US employees and 130 German employees prefer hybrid work. Using a 95% confidence interval for the difference in proportions between US employees and Germany employees. (6 marks)
- (d) In the population, the average IQ is 100 with a standard deviation of 15. A team of scientists want to test a new medication to see if it has either a positive or negative effect on intelligence or not at all. A sample of 30 participants who have taken the medication has a mean of 140. Did the medication affect intelligence? Use level of significance,  $\alpha = 0.05$ .
- i. State the null and alternative hypothesis. (2 marks)
- ii. Compute the test statistic. (3 marks)

(e) Consider the following set of points:  $\{(-1,0), (0,2), (1,4), (2,5)\}$ .

i. Find the least square regression line.

(4 marks)

ii. Find the correlation coefficient,  $r$ .

(4 marks)

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**Question 5**

Answer all questions below.

- (a) In a large company's marketing division, analysts monitor the arrival of customer inquiries through the live chat system and have determined that the time between inquiries can be modeled using an exponential distribution with a rate of 0.18 inquiries per minute. Compute the likelihood that the next inquiry will take more than 8 minutes but less than 11 minutes to arrive. (4 marks)
- (b) A management consulting firm conducts a large customer satisfaction study where the population satisfaction score has a mean of 78 and a known standard deviation of 10. Assume that the information follows a normal distribution. If the sample of 50 customers is selected at random. Find the probability that the sample mean will be more than 76 but less than 79. (4 marks)
- (c) Ahmad is the owner of RST station. He would like to estimate the mean number of gallons of gasoline sold to his customers. Assume the number of gallons sold follows the normal distribution with a population standard deviation of 2.30 gallons. From his records, he selects a random sample of 60 sales and finds the mean number of gallons sold is 8.60.
- Determine the point estimate of the population mean. (2 marks)
  - Develop a 99% confidence interval for the population mean. (3 marks)
  - Develop a 95% confidence interval for the population mean. (3 marks)

- (d) Mariam is the vice president for Nursing Services at HKL Hospital. Recently she noticed in the job postings for nurses that those that are unionized seem to offer higher wages. She decided to investigate and gathered the following information. By using 0.05 significance level, would it be reasonable for her to conclude that union nurses earn more?

*Refer Below - Figure5 : . .*

(4 marks)

Group	Mean Wage	Population Standard Deviation	Sample Size
Union	\$20.75	\$2.25	40
Nonunion	\$19.80	\$1.90	45

Figure 5: .

- (e) The manufacturer of Cardio Glide exercise equipment wants to study the relationship between the number of months since the glide was purchased and the time, in hours, the equipment was used last week. Let hours of exercised be the dependent variable. Determine the equation of the regression line.

*Refer Below - Figure6 : . .*

(5 marks)

Hours Exercised Y	4	10	8	5	5	8	3
Months Owned X	12	2	6	9	7	2	8

Figure 6: .

END OF EXAMINATION PAPER

## FORMULAS AND STATISTICAL TABLE

### PROBABILITY DISTRIBUTIONS

Uniform distribution:

$$P(x) = \frac{1}{(b-a)} \text{ if } a \leq x \leq b \text{ and } 0 \text{ elsewhere}$$

$$\mu = \frac{a+b}{2}$$

$$\sigma = \sqrt{\frac{(b-a)^2}{12}}$$

Exponential distribution:

$$P(\text{arrival time} < x) = 1 - e^{-\lambda x}$$

$$P(\text{arrival time} > x) = e^{-\lambda x}$$

Normal distribution:

$$Z = \frac{X-\mu}{\sigma}$$

Sampling distribution:

$$Z = \frac{\bar{x}-\mu}{\sigma/\sqrt{n}}$$

Standard error:

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}, \sigma_{\bar{p}} = \sqrt{\frac{pq}{n}}$$

### ESTIMATIONS

Population mean:

$$\mu = \frac{\sum x}{n}$$

Sample mean:

$$\bar{x} = \frac{\sum x}{n}$$

Margin of error:

$$E = Z_{\alpha/2} \frac{\sigma}{\sqrt{n}}, E = t_{\alpha/2} \frac{s}{\sqrt{n}}$$

Sample variance:

$$s^2 = \frac{\sum(x-\bar{x})^2}{n-1} @ s^2 = \frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n-1}$$

$$E = Z_{\alpha/2} \sqrt{\frac{\bar{p}(1-\bar{p})}{n}}$$

Sample standard deviation:

$$s = \sqrt{\frac{\sum(x-\bar{x})^2}{n-1}} @ s = \sqrt{\frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n-1}}$$

Confidence interval (one population):

1)  $\sigma$  known:

$$CI = \bar{x} \pm Z_{\alpha/2} \left( \frac{\sigma}{\sqrt{n}} \right)$$

2)  $\sigma$  unknown:

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

Sample proportion:

$$\hat{p} = \frac{x}{n}$$

3) population proportion:

$$CI = \bar{p} \pm Z_{\alpha/2} \sqrt{\frac{\bar{p}(1-\bar{p})}{n}}$$

Sample size:

$$n = \left( \frac{Z\sigma}{E} \right)^2$$

$$n = \frac{(Z)^2 pq}{E^2}$$

Confidence intervals (two populations):

1)  $\sigma_1$  and  $\sigma_2$  are known:

$$CI = (\bar{x}_1 - \bar{x}_2) \pm z_{\alpha/2} \left( \sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}} \right)$$

2)  $\sigma_1$  and  $\sigma_2$  are unknown:

$$CI = (\bar{x}_1 - \bar{x}_2) \pm t_{\alpha/2} \left( \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}} \right)$$

3) two population proportions:

$$CI = (\hat{p}_1 - \hat{p}_2) \pm z_{\alpha/2} \left( \sqrt{\frac{\hat{p}_1 \hat{q}_1}{n_1} + \frac{\hat{p}_2 \hat{q}_2}{n_2}} \right)$$

$$df = \frac{\left( \frac{s_1^2}{n_1} + \frac{s_2^2}{n_2} \right)^2}{\frac{1}{n_1-1} \left( \frac{s_1^2}{n_1} \right)^2 + \frac{1}{n_2-1} \left( \frac{s_2^2}{n_2} \right)^2}$$

### HYPOTHESIS TESTING ONE SAMPLE

1)  $\sigma$  known

$$Z = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}}$$

2)  $\sigma$  unknown

$$t = \frac{\bar{x} - \mu}{s / \sqrt{n}}$$

3) population proportion

$$Z = \frac{\bar{p} - p_0}{\sqrt{\frac{p_0 q_0}{n}}}$$

### HYPOTHESIS TESTING TWO SAMPLE

1)  $\sigma_1$  and  $\sigma_2$  are known

$$Z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}$$

3) two population proportions

$$z = \frac{\hat{p}_1 - \hat{p}_2}{\sqrt{\bar{p}\bar{q}\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} \text{ where } \bar{p} = \frac{p_1 n_1 + p_2 n_2}{n_1 + n_2}$$

$\therefore \bar{p}$  = pooled estimator

2)  $\sigma_1$  and  $\sigma_2$  are unknown

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

4) matched sample

$$t = \frac{\bar{x}_d - \mu_d}{\frac{s_d}{\sqrt{n}}}$$

### REGRESSION AND CORRELATION

Correlation coefficient:

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$$

Regression equation line:

$$y = a + bx$$

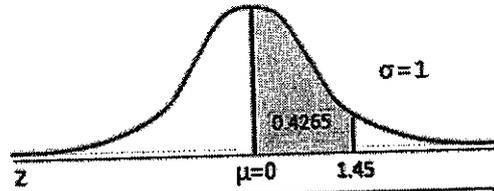
Where:

$$a = \frac{(\sum y)(\sum x^2) - (\sum x)(\sum xy)}{n(\sum x^2) - (\sum x)^2}$$

$$b = \frac{n(\sum xy) - (\sum x)(\sum y)}{n(\sum x^2) - (\sum x)^2}$$

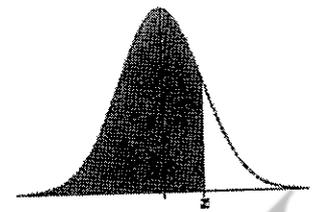
Areas Under the One-Tailed Standard Normal Curve

This table provides the area between the mean and some Z score.  
 For example, when Z score = 1.45 the area = 0.4265.



Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990
3.1	0.4990	0.4991	0.4991	0.4991	0.4992	0.4992	0.4992	0.4992	0.4993	0.4993
3.2	0.4993	0.4993	0.4994	0.4994	0.4994	0.4994	0.4994	0.4995	0.4995	0.4995
3.3	0.4995	0.4995	0.4995	0.4996	0.4996	0.4996	0.4996	0.4996	0.4996	0.4997
3.4	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4998
3.5	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998
3.6	0.4998	0.4998	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.7	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.8	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.9	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000

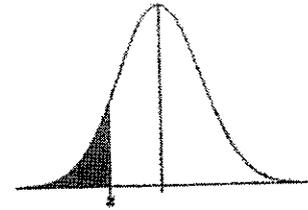
Standard Normal Cumulative Probability Table



Cumulative probabilities for POSITIVE z-values are shown in the following 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

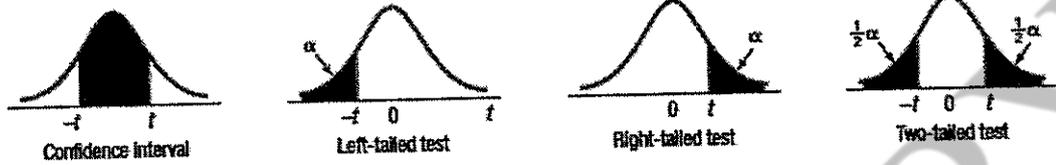
Standard Normal Cumulative Probability Table



Cumulative probabilities for NEGATIVE z-values are shown in the following table:

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
-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

### B.5 Student's t Distribution



Confidence Intervals, $c$						
df	90%	95%	98%	99%	99.9%	
	Level of Significance for One-Tailed Test, $\alpha$					
	0.10	0.05	0.025	0.01	0.005	0.0005
Level of Significance for Two-Tailed Test, $\alpha$						
	0.20	0.10	0.05	0.02	0.01	0.001
1	3.078	6.314	12.706	31.821	63.657	636.619
2	1.886	2.920	4.303	6.965	9.925	31.599
3	1.638	2.353	3.182	4.541	5.841	12.924
4	1.533	2.132	2.776	3.747	4.604	8.610
5	1.476	2.015	2.571	3.365	4.032	6.860
6	1.440	1.943	2.447	3.143	3.707	5.959
7	1.415	1.895	2.365	2.998	3.499	5.406
8	1.397	1.860	2.306	2.896	3.355	5.041
9	1.383	1.833	2.262	2.821	3.250	4.781
10	1.372	1.812	2.228	2.764	3.169	4.587
11	1.363	1.796	2.201	2.718	3.106	4.437
12	1.356	1.782	2.179	2.681	3.055	4.318
13	1.350	1.771	2.160	2.650	3.012	4.221
14	1.345	1.761	2.145	2.624	2.977	4.140
15	1.341	1.753	2.131	2.602	2.947	4.073
16	1.337	1.746	2.120	2.583	2.921	4.015
17	1.333	1.740	2.110	2.567	2.898	3.965
18	1.330	1.734	2.101	2.552	2.878	3.922
19	1.328	1.729	2.093	2.539	2.861	3.883
20	1.325	1.725	2.086	2.528	2.845	3.850
21	1.323	1.721	2.080	2.518	2.831	3.819
22	1.321	1.717	2.074	2.508	2.819	3.792
23	1.319	1.714	2.068	2.500	2.807	3.768
24	1.318	1.711	2.064	2.492	2.797	3.745
25	1.316	1.708	2.060	2.485	2.787	3.725
26	1.315	1.706	2.056	2.479	2.779	3.707
27	1.314	1.703	2.052	2.473	2.771	3.690
28	1.313	1.701	2.048	2.467	2.763	3.674
29	1.311	1.699	2.045	2.462	2.756	3.659
30	1.310	1.697	2.042	2.457	2.750	3.646
31	1.309	1.696	2.040	2.453	2.744	3.633
32	1.309	1.694	2.037	2.449	2.738	3.622
33	1.308	1.692	2.035	2.445	2.733	3.611
34	1.307	1.691	2.032	2.441	2.728	3.601
35	1.306	1.690	2.030	2.438	2.724	3.591

Confidence Intervals, $c$						
df	90%	95%	98%	99%	99.9%	
	Level of Significance for One-Tailed Test, $\alpha$					
	0.10	0.05	0.025	0.01	0.005	0.0005
Level of Significance for Two-Tailed Test, $\alpha$						
	0.20	0.10	0.05	0.02	0.01	0.001
36	1.306	1.688	2.028	2.434	2.719	3.582
37	1.305	1.687	2.026	2.431	2.715	3.574
38	1.304	1.686	2.024	2.429	2.712	3.566
39	1.304	1.685	2.023	2.426	2.708	3.558
40	1.303	1.684	2.021	2.423	2.704	3.551
41	1.303	1.683	2.020	2.421	2.701	3.544
42	1.302	1.682	2.018	2.418	2.698	3.538
43	1.302	1.681	2.017	2.416	2.695	3.532
44	1.301	1.680	2.015	2.414	2.692	3.526
45	1.301	1.679	2.014	2.412	2.690	3.520
46	1.300	1.679	2.013	2.410	2.687	3.515
47	1.300	1.678	2.012	2.408	2.685	3.510
48	1.299	1.677	2.011	2.407	2.682	3.505
49	1.299	1.677	2.010	2.405	2.680	3.500
50	1.299	1.676	2.009	2.403	2.678	3.496
51	1.298	1.675	2.008	2.402	2.676	3.492
52	1.298	1.675	2.007	2.400	2.674	3.488
53	1.298	1.674	2.006	2.399	2.672	3.484
54	1.297	1.674	2.005	2.397	2.670	3.480
55	1.297	1.673	2.004	2.396	2.668	3.476
56	1.297	1.673	2.003	2.395	2.667	3.473
57	1.297	1.672	2.002	2.394	2.665	3.470
58	1.296	1.672	2.002	2.392	2.663	3.466
59	1.296	1.671	2.001	2.391	2.662	3.463
60	1.296	1.671	2.000	2.390	2.660	3.460
61	1.296	1.670	2.000	2.389	2.659	3.457
62	1.295	1.670	1.999	2.388	2.657	3.454
63	1.295	1.669	1.998	2.387	2.656	3.452
64	1.295	1.669	1.998	2.386	2.655	3.449
65	1.295	1.669	1.997	2.385	2.654	3.447
66	1.295	1.668	1.997	2.384	2.652	3.444
67	1.294	1.668	1.996	2.383	2.651	3.442
68	1.294	1.668	1.995	2.382	2.650	3.439
69	1.294	1.667	1.995	2.382	2.649	3.437
70	1.294	1.667	1.994	2.381	2.648	3.435

(continued)

**B.5 Student's t Distribution (concluded)**

Confidence Intervals, <i>c</i>						
df	80%	90%	95%	98%	99%	99.9%
	Level of Significance for One-Tailed Test, $\alpha$					
	0.10	0.05	0.025	0.01	0.005	0.0005
	Level of Significance for Two-Tailed Test, $\alpha$					
	0.20	0.10	0.05	0.02	0.01	0.001
71	1.294	1.667	1.994	2.390	2.647	3.433
72	1.293	1.666	1.993	2.379	2.646	3.431
73	1.293	1.666	1.993	2.379	2.645	3.429
74	1.293	1.666	1.993	2.378	2.644	3.427
75	1.293	1.665	1.992	2.377	2.643	3.425
76	1.293	1.665	1.992	2.376	2.642	3.423
77	1.293	1.665	1.991	2.376	2.641	3.421
78	1.292	1.665	1.991	2.375	2.640	3.420
79	1.292	1.664	1.990	2.374	2.640	3.418
80	1.292	1.664	1.990	2.374	2.639	3.418
81	1.292	1.664	1.990	2.373	2.638	3.415
82	1.292	1.664	1.990	2.373	2.637	3.413
83	1.292	1.663	1.989	2.372	2.636	3.412
84	1.292	1.663	1.989	2.372	2.636	3.410
85	1.292	1.663	1.988	2.371	2.635	3.409
86	1.291	1.663	1.988	2.370	2.634	3.407
87	1.291	1.663	1.988	2.370	2.634	3.406
88	1.291	1.662	1.987	2.369	2.633	3.405

Confidence Intervals, <i>c</i>						
df	80%	90%	95%	98%	99%	99.9%
	Level of Significance for One-Tailed Test, $\alpha$					
	0.10	0.05	0.025	0.01	0.005	0.0005
	Level of Significance for Two-Tailed Test, $\alpha$					
	0.20	0.10	0.05	0.02	0.01	0.001
89	1.291	1.662	1.987	2.369	2.632	3.403
90	1.291	1.662	1.987	2.368	2.632	3.402
91	1.291	1.662	1.986	2.368	2.631	3.401
92	1.291	1.662	1.986	2.368	2.630	3.399
93	1.291	1.661	1.986	2.367	2.630	3.398
94	1.291	1.661	1.986	2.367	2.629	3.397
95	1.291	1.661	1.985	2.366	2.629	3.396
96	1.290	1.661	1.985	2.366	2.628	3.395
97	1.290	1.661	1.985	2.365	2.627	3.394
98	1.290	1.661	1.984	2.365	2.627	3.393
99	1.290	1.660	1.984	2.365	2.626	3.392
100	1.290	1.660	1.984	2.364	2.626	3.390
120	1.289	1.658	1.980	2.358	2.617	3.373
140	1.288	1.656	1.977	2.353	2.611	3.361
160	1.287	1.654	1.975	2.350	2.607	3.352
180	1.286	1.653	1.973	2.347	2.603	3.345
200	1.286	1.653	1.972	2.345	2.601	3.340
$\infty$	1.282	1.645	1.960	2.326	2.576	3.291