NCI
Coláiste Náisiúnta na hÉireann | National College of Ireland

Statistical Formulae and Tables

MATHS.SUPPORT@NCIRL.IE

YouTube

LibGuide

Compiled & edited by Jonathan Lambert
Mathematics Development & Support

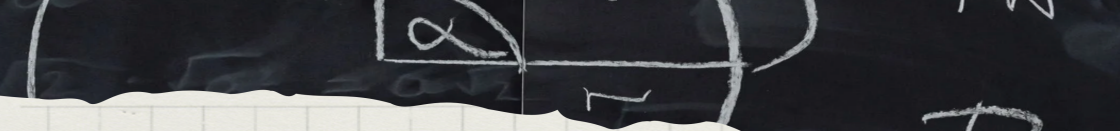


Table of Contents

DESCRIPTIVE STATISTICS 5

COUNTING RULES 8

PERMUTATIONS AND COMBINATIONS 8

RULES OF PROBABILITY 9

BINOMIAL DISTRIBUTION 10

POISSON DISTRIBUTION 10

NORMAL DISTRIBUTION 10

CORRELATION 11

REGRESSION 12

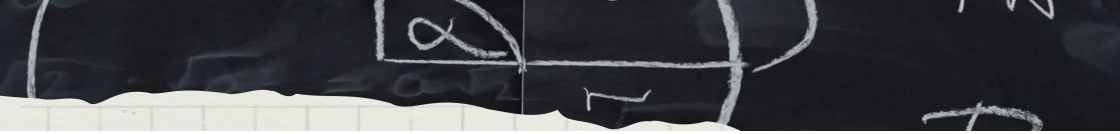
GAUSS-MARKOV ASSUMPTIONS 16

INFERENTIAL STATISTICS 17

CONFIDENCE INTERVAL ESTIMATION 21

ANALYSIS OF VARIANCE 22

TESTS OF NORMALITY 22



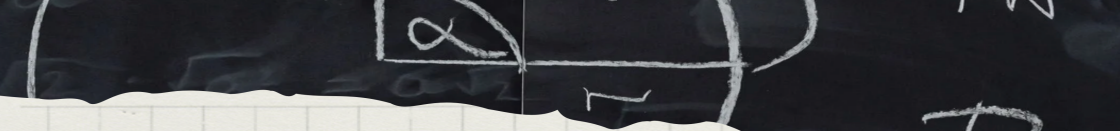
Foreword

Statistics forms an essential foundation for evidence-based decision-making across disciplines including business, computing, psychology, social science, economics, healthcare, and education. Yet for many learners, statistics can initially appear complex and formula-heavy, often creating unnecessary barriers to confidence and understanding. The purpose of this booklet is to reduce that barrier by providing students with a practical, accessible, and concise reference guide to the core statistical formulae and tables most commonly encountered in quantitative modules.

This *Statistical Formulae and Tables* booklet has been developed to support students in navigating the mathematical and analytical components of statistics with greater clarity and confidence. It brings together key descriptive and inferential statistical formulae, probability distributions, regression methods, hypothesis testing procedures, measures of association, and statistical reference tables in a single, structured resource. Rather than replacing conceptual understanding, this guide is intended to complement teaching, learning, and problem-solving by helping students focus on interpretation, reasoning, and statistical thinking.

Particular attention has been given to presenting material in a way that is practical for classroom use, independent study, tutorials, and assessment preparation. The booklet is designed to serve both as a quick-reference companion during quantitative learning and as a bridge between statistical theory and applied problem-solving. Whether students are calculating descriptive measures, conducting hypothesis tests, interpreting regression models, or working with probability distributions, the intention is that this guide will provide a reliable point of reference throughout their studies.

Importantly, statistics is not simply about applying formulae; it is about developing the ability to interpret evidence, evaluate uncertainty, and



make informed decisions grounded in data. Formulae are therefore best understood not as ends in themselves, but as tools that support analytical thinking and meaningful interpretation.

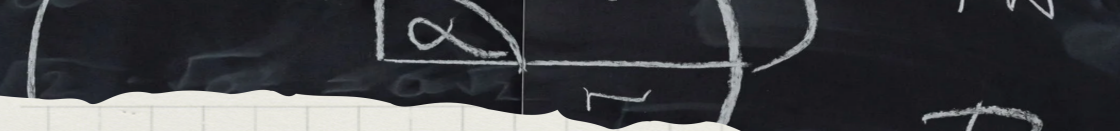
It is hoped that this booklet will contribute positively to students' confidence in quantitative methods and encourage a more approachable, structured, and applied engagement with statistics.

We also like to thank Dr Corina Sheerin, School of Business and Social Sciences, National College of Ireland, for her careful proofreading and valuable comments on this revised edition.

Dr Jonathan Lambert
Mathematics Development and Support
National College of Ireland

(Revised Edition 2026)

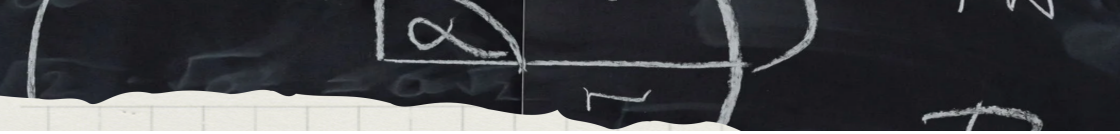
ISBN: 978-0-905957-50-0



Descriptive Statistics Symbols

Population Statistical Symbols	
Symbol	**Meaning**
N	Size of the Population
x	An observation from the Population
m	Midpoint of a grouped frequency distribution class
μ	Mean of the Population
σ^2	Variance of the Population
σ	Standard Deviation of the Population
f	Frequency of Occurrence
F	Cumulative Frequency
ρ	Correlation Coefficient

Sample Statistical Symbols	
Symbol	**Meaning**
n	Size of the Sample
x	An observation from the Sample
m	Midpoint of a grouped frequency distribution class
$\bar{x}$	Mean of the Sample
s^2	Variance of the Sample
s	Standard Deviation of the Sample
f	Frequency of Occurrence
F	Cumulative Frequency
r	Correlation Coefficient

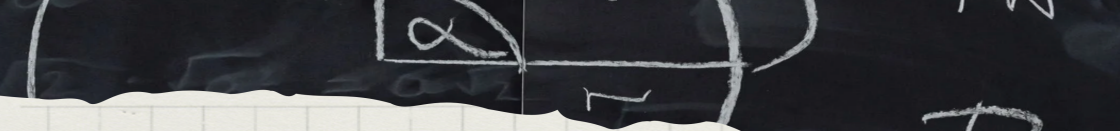


Population Parameters and Sample Statistic Formulae when dealing with Raw Data

	Population	Sample
Mean	$\mu = \frac{\sum x}{N}$	$\bar{x} = \frac{\sum x}{n}$
Variance	$\sigma^2 = \frac{\sum (x - \mu)^2}{N}$	$s^2 = \frac{\sum (x - \bar{x})^2}{n - 1}$
Standard Deviation	$\sigma = \sqrt{\frac{\sum (x - \mu)^2}{N}}$	$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}$

Population Parameters and Sample Statistic Formulae when dealing with Discrete Frequency Distributions

	Population	Sample
Mean	$\mu = \frac{\sum fx}{\sum f}$	$\bar{x} = \frac{\sum fx}{\sum f}$
Variance	$\sigma^2 = \frac{\sum f(x - \mu)^2}{\sum f}$	$s^2 = \frac{\sum f(x - \bar{x})^2}{\sum f - 1}$
Standard Deviation	$\sigma = \sqrt{\frac{\sum f(x - \mu)^2}{\sum f}}$	$s = \sqrt{\frac{\sum f(x - \bar{x})^2}{\sum f - 1}}$



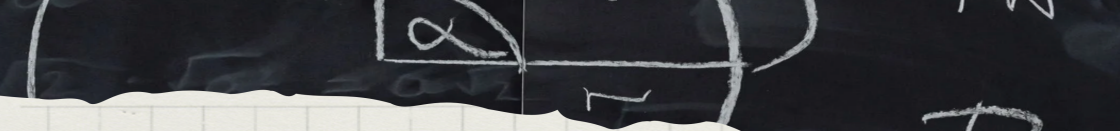
Population Parameters and Sample Statistic Formulae when dealing with Grouped Frequency Distributions and Class Interval Midpoints

	Population	Sample
Mean	$\mu = \frac{\sum fm}{\sum f}$	$\bar{x} = \frac{\sum fm}{\sum f}$
Variance	$\sigma^2 = \frac{\sum f(m - \mu)^2}{\sum f}$	$s^2 = \frac{\sum f(m - \bar{x})^2}{\sum f - 1}$
Standard Deviation	$\sigma = \sqrt{\frac{\sum f(m - \mu)^2}{\sum f}}$	$s = \sqrt{\frac{\sum f(m - \bar{x})^2}{\sum f - 1}}$

Quartiles and Mode given a Frequency Distribution

1st Quartile	$Q_1 = L_{Q1} + \left(\frac{\frac{\sum f}{4} - F_{Q1-1}}{f_{Q1}}\right) . C_{Q1}$
2nd Quartile (Median)	$Q_2 = L_{Q2} + \left(\frac{\frac{\sum f}{2} - F_{Q2-1}}{f_{Q2}}\right) . C_{Q2}$
3nd Quartile	$Q_3 = L_{Q3} + \left(\frac{\frac{3\sum f}{4} - F_{Q3-1}}{f_{Q3}}\right) . C_{Q3}$

Mode	$Mode = L + \left(\frac{D_1}{D_1 + D_2}\right) . C_M$

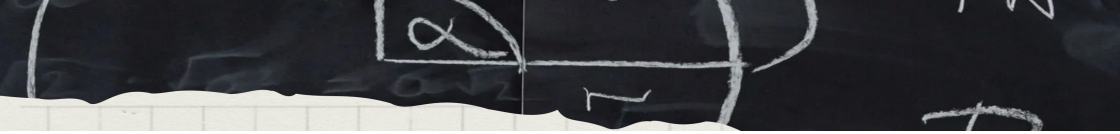


Counting Rules

Rule 1: If any one of k mutually exclusive and exhaustive events can occur on each of n trials, the number of possible outcomes is equal to:	k^n
Rule 2: If there are k_1 events on the first trial, k_2 events on the second trial, ..., and k_n events on the nth trial, then the number of possible outcomes is:	$(k_1)(k_2) \dots (k_n)$
Rule 3: The number of ways that all n items can be arranged in order is:	$n! = (n)(n-1) \dots (1)$ **where** $n!$ is called n factorial and $0!$ is defined as 1.

Permutations and Combinations

Rule 4 (Permutations): The number of ways of arranging x objects selected from n objects in order is:	$^nP_x = \frac{n!}{(n-x)!}$
Rule 5 (Combinations): The number of combinations from selecting **x** objects from **n** objects, irrespective of order, is equal to:	$^nC_x = \frac{n!}{x!\,(n-x)!}$



Rules of Probability

Probability of occurrence of a simple event $\boldsymbol{A}$.	$\boldsymbol{P(A) = \frac{Number\ of\ Favourable\ Outcomes}{Number\ of\ Possible\ Outcomes}}$

Addition Rule of Probability

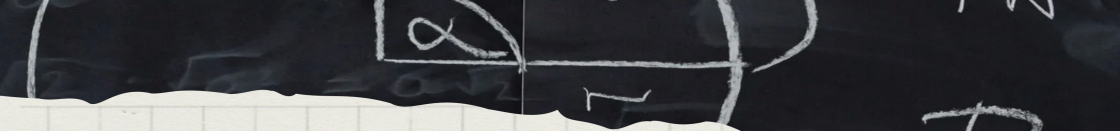
When A and B **are not** mutually exclusive	$\boldsymbol{P(A\ or\ B) = P(A) + P(B) - P(A\ and\ B)}$
When A and B **are** mutually exclusive	$\boldsymbol{P(A\ or\ B) = P(A) + P(B)}$

Multiplication Rule of Probability

When A and B **are not** independent	$\boldsymbol{P(A\ and\ B) = P(A)P(B\|A)}$
When A and B **are** independent	$\boldsymbol{P(A\ and\ B) = P(A)P(B)}$

Bayes Theorem

To find the conditional probability of **B** given **A**	$\boldsymbol{P(B\|A) = \frac{P(A\|B)P(B)}{P(A)}}$ **alternatively** $\boldsymbol{P(B\|A) = \frac{P(A\|B)P(B)}{P(A\|B)P(B) + P(A\|B^c)P(B^c)}}$



Binomial Distribution

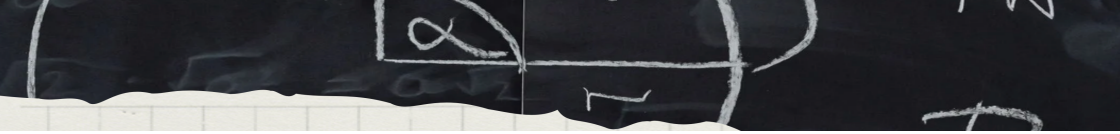
The probability of **x** successes given the number of observations **n** and the probability of success **p**	$P(X = x) = {}^{n}C_{x}\, p^{x}\, (1-p)^{n-x}$
Expected value of the Binomial Distribution (Mean)	$E(X) = np$
Variance of the Binomial Distribution	$Var(X) = np(1-p)$

Poisson Distribution

The probability of **X** events occurring given the expected number of events λ	$P(X = x) = \frac{e^{-\lambda}\lambda^{x}}{x!}$
Expected value of the Poisson Distribution (Mean)	$E(X) = \lambda$
Variance of the Poisson Distribution	$Var(X) = \lambda$

Normal Distribution

The probability of **X** events occurring given the expected number of events λ	$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\left[\frac{(x-\mu)^2}{2\sigma^2}\right]}$
Expected value of the Normal Distribution	$E(X) = \mu$
Variance of the Normal Distribution	$Var(X) = \sigma^2$

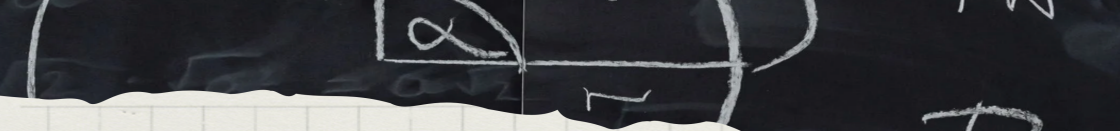


Correlation

Sample Covariance	$$Cov(X,Y) = \frac{\sum(x-\bar{x})(y-\bar{y})}{n-1}$$

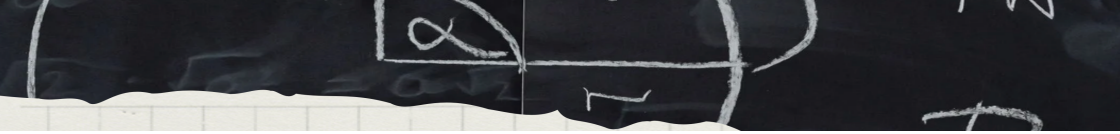
Spearman Rank Correlation Coefficient	$$r_s = 1 - \frac{6\sum_{i=1}^{n} d_i^2}{n(n^2-1)}$$

Pearson Product Moment Correlation Coefficient	$$r = \frac{n\sum xy - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$$ **alternatively** $$r = \frac{\sum[(x-\bar{x})(y-\bar{y})]}{\sqrt{\sum(x-\bar{x})^2\sum(y-\bar{y})^2}}$$ **alternatively** $$r = \frac{cov(X,Y)}{S_X S_Y}$$



Regression (Single Independent Variable)

Linear Regression Function	$$y = b_0 + b_1 x$$
Slope of the Regression Line	$$b_1 = \frac{n\sum xy - (\sum x)(\sum y)}{n\sum x^2 - (\sum x)^2}$$ **alternatively** $$b_1 = r\frac{s_Y}{s_X}$$
y-Intercept of the Regression Line	$$b_0 = \frac{\sum y}{n} - b_1\frac{\sum x}{n}$$ **alternatively** $$b_0 = \overline{Y} - b_1\overline{X}$$

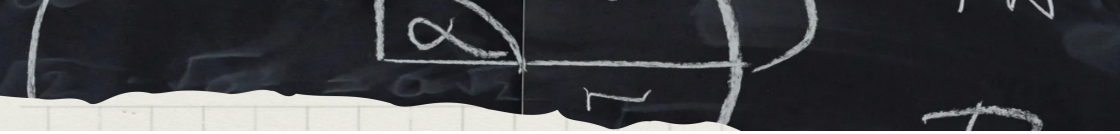


Regression (Two Independent Variables)

Linear Regression Function	$$Y' = b_0 + b_1 X_1' + b_2 X_2'$$
Regression Equation Slope Coefficients	$$b_1 = \frac{(\sum x_2^2)(\sum x_1 y) - (\sum x_1 x_2)(\sum x_2 y)}{(\sum x_1^2)(\sum x_2^2) - (\sum x_1 x_2)^2}$$ $$b_2 = \frac{(\sum x_1^2)(\sum x_2 y) - (\sum x_1 x_2)(\sum x_1 y)}{(\sum x_1^2)(\sum x_2^2) - (\sum x_1 x_2)^2}$$
Y-Intercept of Regression Plane	$$b_0 = \overline{Y} - b_1 \overline{X}_1 - b_2 \overline{X}_2$$
Regression Equation Slope Coefficient Sums of Squares, and Cross Products	$$\sum y^2 = \sum Y^2 - \frac{(\sum Y)^2}{N}$$ $$\sum x_i^2 = \sum X_i^2 - \frac{(\sum X_i)^2}{N}$$ $$\sum x_i y = \sum X_i Y - \frac{(\sum X_i)(\sum Y)}{N}$$ $$\sum x_1 x_2 = \sum X_1 X_2 - \frac{(\sum X_1)(\sum X_2)}{N}$$

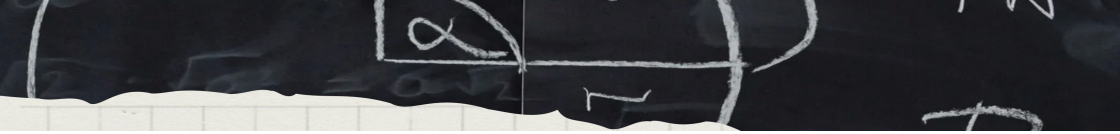
Regression Equation Slope Coefficients in Matrix Notation

Regression Equation Slope Coefficients in Matrix Notation	**Given** $$Y = \begin{pmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{pmatrix}$$ **and** $$X = \begin{pmatrix} 1 & x_{11} & \cdots & x_{1p} \\ 1 & x_{21} & \cdots & x_{2p} \\ \vdots & \vdots & \cdots & \vdots \\ 1 & x_{n1} & \cdots & x_{np} \end{pmatrix}$$ **Then the vector of coefficients is given by** $$\begin{pmatrix} b_1 \\ b_2 \\ \vdots \\ b_p \end{pmatrix} = (X^T X)^{-1} X^T Y$$ **and** $$b_0 = \bar{Y} - b_1 \bar{X}_1 - b_2 \bar{X}_2 - \cdots - b_p \bar{X}_p$$



Regression Sums of Squares

Regression Sum of Squares	$$SSR = \sum(\hat{Y}_i - \overline{Y})^2$$
Error Sum of Squares	$$SSE = \sum(Y_i - \hat{Y}_i)^2$$
Total Sum of Squares	$$SST = \sum(Y_i - \overline{Y})^2$$ $$SST = SSR + SSE$$
Coefficient of Determination R^2	$$R^2 = \frac{SSR}{SST}$$ **alternatively** $$R^2 = 1 - \frac{SSE}{SST}$$
Adjusted Coefficient of Determination R^2_{adj}	$$R^2_{adj} = 1 - \left(\frac{n-1}{n-k-1}\right)(1 - R^2)$$



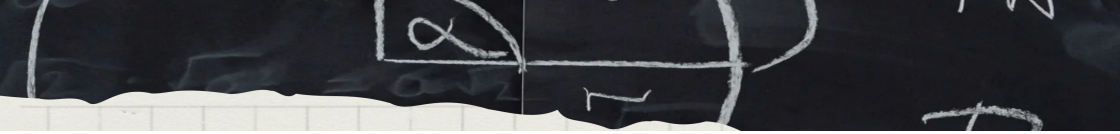
Gauss-Markov Assumptions

Given a Regression of Y on $X_1, X_2, \ldots, X_k$ we define the regression residual error $\boldsymbol{e_i}$ as	$$\boldsymbol{e_i = [Y_i - (b_0 + b_1 X_{i1} + \cdots + b_k X_{ik})]}$$ **or** $$\boldsymbol{e_i = (Y_i - \hat{Y}_i)}$$

Durbin-Watson Statistic for First-Order Autocorrelation in Regression Residuals	$$\boldsymbol{d = \frac{\sum (e_t - e_{t-1})^2}{\sum e_t^2}}$$

Variance Inflation Factor for Assessing Multicollinearity in a Multiple Regression (with independent variable j regressed on all other independent variables)	$$\boldsymbol{VIF = \frac{1}{1 - r_j^2}}$$

Breusch-Pagan Statistic for Heteroskedasticity in a Multiple Regression	$$\boldsymbol{BP = nR_{aux}^2}$$ $$\boldsymbol{df = k - 1}$$ **Given** $$\boldsymbol{g_i = \frac{e_i^2}{\sigma_e^2}}$$ **Where** $$\boldsymbol{\sigma_e^2 = \frac{\sum e_i^2}{n}}$$ **Regressing** $$\boldsymbol{g_i \ on. X_1, X_2, \ldots, X_k}$$ **Then** $$\boldsymbol{BP_{\chi^2} = \frac{(SST_{aux} - SSR_{aux})}{2}}$$ $$\boldsymbol{df = k - 1}$$

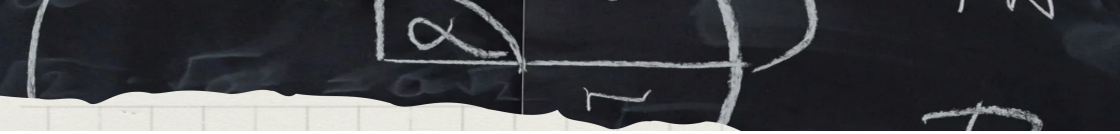


Standard Normal Transformation

Standardised Normal Transformation	$Z = \frac{X - \mu}{\sigma}$
Standardised Normal Transformation for a Sampling Distribution (σ known)	$Z = \frac{\bar{X} - \mu}{\frac{\sigma}{\sqrt{n}}}$
Standardised Normal Transformation for a Sampling Distribution (σ unknown)	$t = \frac{\bar{X} - \mu}{\frac{s}{\sqrt{n}}}$

Inferential Statistics: Single Sample Hypothesis Tests (Parametric)

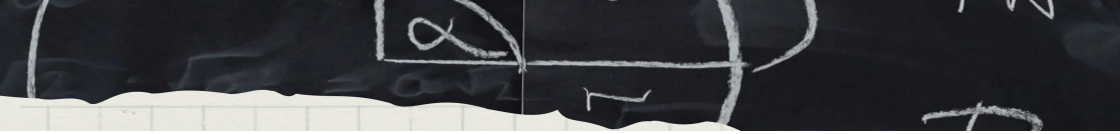
Test Statistic for Hypothesis Tests of the Single Population Mean (σ known)	$z = \frac{\bar{X} - \mu_0}{\frac{\sigma}{\sqrt{n}}}$
Test Statistic for Hypothesis Tests of the Single Population Mean (σ unknown)	$t_{n-1} = \frac{\bar{X} - \mu_0}{\frac{s}{\sqrt{n}}} \qquad df = n - 1$
Test Statistic for Hypothesis Tests of the Single Population Proportion	$z = \frac{p - \pi}{\sqrt{\frac{\pi(1-\pi)}{n}}}$
Test Statistic for Tests Concerning the Value of a Single Population Variance	$\chi^2 = \frac{(n-1)s^2}{\sigma_0^2} \qquad df = n - 1$



Inferential Statistics: Two-Sample Hypothesis Testing (Parametric)

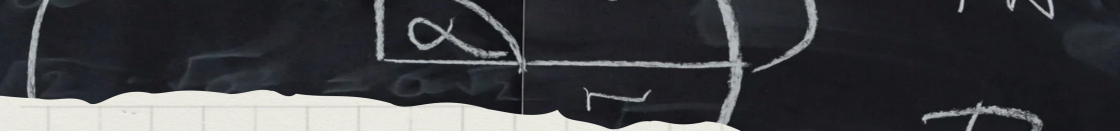
Test Statistic for a Test of the Difference between Two Population Means (σ known)	$$Z = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}$$
Test Statistic for a Test of the Difference between Two Population Means (σ unknown; assumed equal)	$$t = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_p^2}{n_1} + \frac{s_p^2}{n_2}}}$$ $$s_p^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}$$ $$df = n_1 + n_2 - 2$$
Test Statistic for a Test of the Difference between Two Population Means (σ unknown; assumed unequal)	$$t = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$ $$df = \frac{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)^2}{\frac{\left(s_1^2/n_1\right)^2}{n_1 - 1} + \frac{\left(s_2^2/n_2\right)^2}{n_2 - 1}}$$
Test Statistic for a Test of Mean Differences (σ known)	$$z = \frac{\bar{d} - \mu_d}{\frac{\sigma_d}{\sqrt{n}}}$$

Test Statistic for a Test of Mean Differences (σ unknown)	$$t_{n-1} = \frac{\bar{d} - \mu_d}{\frac{s_d}{\sqrt{n}}} \qquad df = n - 1$$ **alternatively** $$t_{n-1} = \frac{\sum D}{\sqrt{\frac{n\sum D^2 - (\sum D)^2}{n-1}}} \qquad df = n - 1$$
Test Statistic for a Test of the Difference between Two Population Proportions	$$z = \frac{(p_1 - p_2) - (\pi_1 - \pi_2)}{\sqrt{\bar{p}(1-\bar{p})\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$ $$\bar{p} = \frac{X_1 + X_2}{n_1 + n_2} \quad p_1 = \frac{X_1}{n_1} \quad p_2 = \frac{X_2}{n_2}$$
Test Statistic for the Difference between Two Population Variances	$$F = \frac{s_1^2}{s_2^2}$$ $$df_{numerator} = n_1 - 1$$ $$df_{denominator} = n_2 - 1$$
Test Statistic for Tests of Independence between two Variables (Chi-square)	$$\chi^2 = \sum\left(\frac{(f_o - f_e)^2}{f_e}\right) \qquad df = (r-1)(c-1)$$ $$f_e = \frac{Row\ total \times Column\ Total}{n}$$ **alternatively** $$\chi^2 = \sum\left(\frac{(O-E)^2}{E}\right)$$



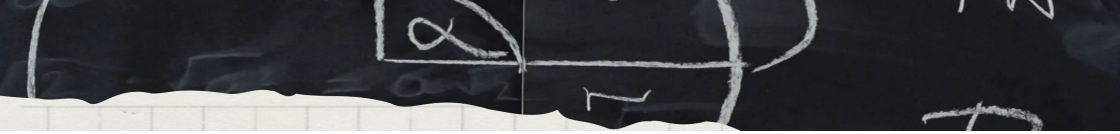
Inferential Statistics: Hypothesis Testing Significance of Correlation and Regression Coefficients

Test Statistic for the Spearman Rank Correlation Coefficient (r_s)	$t_{n-2} = \frac{r_s\sqrt{(n-2)}}{\sqrt{(1-r_s^2)}} \qquad df = n-2$
Test Statistic for the Pearson Product Moment Correlation Coefficient (r)	$t_{n-2} = \frac{r\sqrt{(n-2)}}{\sqrt{(1-r^2)}} \qquad df = n-2$
Test Statistic for the Population Slope in a Regression	$t_{n-k-1} = \frac{b_i - \beta_i}{SE(b_i)} \qquad df = n-k-1$
Standard Error of a Regression Coefficient	$SE(b_i) = \frac{\sum(y-\hat{y})^2}{\sqrt{\sum(x-\bar{x}_i)^2}}$



Confidence Interval Estimation

Confidence Interval for a Mean (**σ** known)	$\bar{X} \pm Z\frac{\sigma}{\sqrt{n}}$ **alternatively** $\bar{X} - Z\frac{\sigma}{\sqrt{n}} \leq \mu \leq \bar{X} + Z\frac{\sigma}{\sqrt{n}}$
Confidence Interval for a Mean (**σ** unknown)	$\bar{X} \pm t_{n-1}\frac{s}{\sqrt{n}}$ **alternatively** $\bar{X} - t_{n-1}\frac{s}{\sqrt{n}} \leq \mu \leq \bar{X} + t_{n-1}\frac{s}{\sqrt{n}}$
Confidence Interval for a single Proportion	$p \pm z\sqrt{\frac{p(1-p)}{n}}$ **alternatively** $p - z\sqrt{\frac{p(1-p)}{n}} < \pi < p + z\sqrt{\frac{p(1-p)}{n}}$
Confidence Interval for the Difference between Two Dependent Population Means	$(\bar{X}_1 - \bar{X}_2) \pm t_{n_1+n_2-2}\sqrt{s_p^2\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}$
Confidence Interval for the Difference between Two Dependent Population Means	$\bar{d} \pm t_{n-1}\frac{s_{\bar{d}}}{\sqrt{n}}$

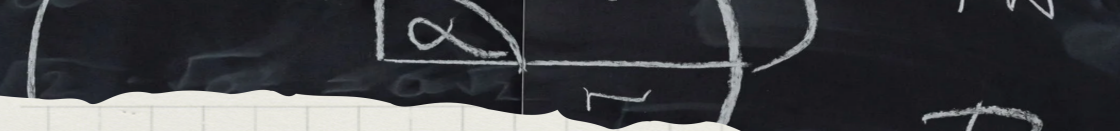


Analysis of Variance (ANOVA)

Within Groups Mean Sum of Squares	$$MSS_W = \frac{\sum_{g \epsilon G} (X - \bar{X}_g)^2}{n - k}$$
Between Groups Mean Sum of Squares	$$MSS_B = \frac{\sum_{g \epsilon G} n_g(\bar{X}_g - \bar{X}_G)^2}{k - 1}$$
Test Statistic for the Difference between more than two Population Means	$$F = \frac{MSS_B}{MSS_W}$$ $$df_B = k - 1$$ $$df_W = n - k$$

Tests of Normality

Shapiro Wilks Test of Normality	$$W = \frac{b^2}{SS}$$ **where** $$SS = \sum (x - \bar{x})^2$$ $$b = \sum_{i=1}^{m} a_i \left(x_{(n+1-i)} - x_i\right)$$ **and** $$\begin{cases} n\ even: & m = \frac{n}{2} \\ n\ odd: & m = \frac{(n-1)}{2} \end{cases}$$



Cumulative Probability Tables for a Standard Normal Distribution

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.00	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.10	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.20	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.30	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.40	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.50	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.60	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.70	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.80	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.90	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.00	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.10	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.20	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.30	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.40	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.50	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.60	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.70	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.80	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.90	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.00	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.10	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.20	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.30	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.40	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.50	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.60	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.70	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.80	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.90	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.00	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.10	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.20	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.30	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.40	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998
3.50	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998
3.60	0.9998	0.9998	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.70	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.80	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.90	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
4.00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

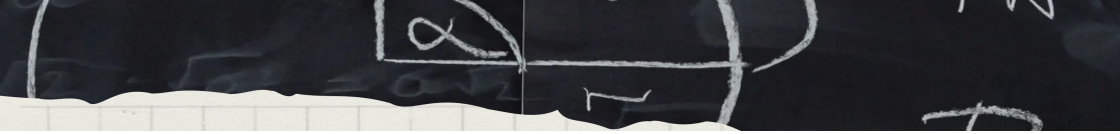


Table of the Student's t-Distribution

Critical values for right-hand tail areas

	Probability in Right-hand Tail				
df	**0.10**	**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
31	1.309	1.696	2.040	2.453	2.744
32	1.309	1.694	2.037	2.449	2.738
33	1.308	1.692	2.035	2.445	2.733
34	1.307	1.691	2.032	2.441	2.728
35	1.306	1.690	2.030	2.438	2.724
36	1.306	1.688	2.028	2.434	2.719
37	1.305	1.687	2.026	2.431	2.715
38	1.304	1.686	2.024	2.429	2.712
39	1.304	1.685	2.023	2.426	2.708
40	1.303	1.684	2.021	2.423	2.704
41	1.303	1.683	2.020	2.421	2.701
42	1.302	1.682	2.018	2.418	2.698
43	1.302	1.681	2.017	2.416	2.695
44	1.301	1.680	2.015	2.414	2.692
45	1.301	1.679	2.014	2.412	2.690
46	1.300	1.679	2.013	2.410	2.687
47	1.300	1.678	2.012	2.408	2.685
48	1.299	1.677	2.011	2.407	2.682
49	1.299	1.677	2.010	2.405	2.680
50	1.299	1.676	2.009	2.403	2.678
60	1.296	1.671	2.000	2.390	2.660
70	1.294	1.667	1.994	2.381	2.648
80	1.292	1.664	1.990	2.374	2.639
90	1.291	1.662	1.987	2.368	2.632
100	1.290	1.660	1.984	2.364	2.626
110	1.289	1.659	1.982	2.361	2.621
120	1.289	1.658	1.980	2.358	2.617
200	1.286	1.653	1.972	2.345	2.601

Table of χ_2 Distribution

	Probability in Right Tail								
df	**0.99**	**0.975**	**0.95**	**0.9**	**0.1**	**0.05**	**0.025**	**0.01**	**0.005**
1	0.000	0.001	0.004	0.016	2.706	3.841	5.024	6.635	7.879
2	0.020	0.051	0.103	0.211	4.605	5.991	7.378	9.210	10.597
3	0.115	0.216	0.352	0.584	6.251	7.815	9.348	11.345	12.838
4	0.297	0.484	0.711	1.064	7.779	9.488	11.143	13.277	14.860
5	0.554	0.831	1.145	1.610	9.236	11.070	12.833	15.086	16.750
6	0.872	1.237	1.635	2.204	10.645	12.592	14.449	16.812	18.548
7	1.239	1.690	2.167	2.833	12.017	14.067	16.013	18.475	20.278
8	1.646	2.180	2.733	3.490	13.362	15.507	17.535	20.090	21.955
9	2.088	2.700	3.325	4.168	14.684	16.919	19.023	21.666	23.589
10	2.558	3.247	3.940	4.865	15.987	18.307	20.483	23.209	25.188
11	3.053	3.816	4.575	5.578	17.275	19.675	21.920	24.725	26.757
12	3.571	4.404	5.226	6.304	18.549	21.026	23.337	26.217	28.300
13	4.107	5.009	5.892	7.042	19.812	22.362	24.736	27.688	29.819
14	4.660	5.629	6.571	7.790	21.064	23.685	26.119	29.141	31.319
15	5.229	6.262	7.261	8.547	22.307	24.996	27.488	30.578	32.801
16	5.812	6.908	7.962	9.312	23.542	26.296	28.845	32.000	34.267
17	6.408	7.564	8.672	10.085	24.769	27.587	30.191	33.409	35.718
18	7.015	8.231	9.390	10.865	25.989	28.869	31.526	34.805	37.156
19	7.633	8.907	10.117	11.651	27.204	30.144	32.852	36.191	38.582
20	8.260	9.591	10.851	12.443	28.412	31.410	34.170	37.566	39.997
21	8.897	10.283	11.591	13.240	29.615	32.671	35.479	38.932	41.401
22	9.542	10.982	12.338	14.041	30.813	33.924	36.781	40.289	42.796
23	10.196	11.689	13.091	14.848	32.007	35.172	38.076	41.638	44.181
24	10.856	12.401	13.848	15.659	33.196	36.415	39.364	42.980	45.559
25	11.524	13.120	14.611	16.473	34.382	37.652	40.646	44.314	46.928
26	12.198	13.844	15.379	17.292	35.563	38.885	41.923	45.642	48.290
27	12.879	14.573	16.151	18.114	36.741	40.113	43.195	46.963	49.645
28	13.565	15.308	16.928	18.939	37.916	41.337	44.461	48.278	50.993
29	14.256	16.047	17.708	19.768	39.087	42.557	45.722	49.588	52.336
30	14.953	16.791	18.493	20.599	40.256	43.773	46.979	50.892	53.672
40	22.164	24.433	26.509	29.051	51.805	55.758	59.342	63.691	66.766
50	29.707	32.357	34.764	37.689	63.167	67.505	71.420	76.154	79.490
60	37.485	40.482	43.188	46.459	74.397	79.082	83.298	88.379	91.952
70	45.442	48.758	51.739	55.329	85.527	90.531	95.023	100.425	104.215
80	53.540	57.153	60.391	64.278	96.578	101.879	106.629	112.329	116.321
90	61.754	65.647	69.126	73.291	107.565	113.145	118.136	124.116	128.299
100	70.065	74.222	77.929	82.358	118.498	124.342	129.561	135.807	140.169

Table of the F-Distribution

Critical values for right-hand tail area equal to **0.10**

df1:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
df2: 1	39.9	49.5	53.6	55.8	57.2	58.2	58.9	59.4	59.9	60.2	60.5	60.7	60.9	61.1	61.2
2	8.53	9.00	9.16	9.24	9.29	9.33	9.35	9.37	9.38	9.39	9.40	9.41	9.41	9.42	9.42
3	5.54	5.46	5.39	5.34	5.31	5.28	5.27	5.25	5.24	5.23	5.22	5.22	5.21	5.20	5.20
4	4.54	4.32	4.19	4.11	4.05	4.01	3.98	3.95	3.94	3.92	3.91	3.90	3.89	3.88	3.87
5	4.06	3.78	3.62	3.52	3.45	3.40	3.37	3.34	3.32	3.30	3.28	3.27	3.26	3.25	3.24
6	3.78	3.46	3.29	3.18	3.11	3.05	3.01	2.98	2.96	2.94	2.92	2.90	2.89	2.88	2.87
7	3.59	3.26	3.07	2.96	2.88	2.83	2.78	2.75	2.72	2.70	2.68	2.67	2.65	2.64	2.63
8	3.46	3.11	2.92	2.81	2.73	2.67	2.62	2.59	2.56	2.54	2.52	2.50	2.49	2.48	2.46
9	3.36	3.01	2.81	2.69	2.61	2.55	2.51	2.47	2.44	2.42	2.40	2.38	2.36	2.35	2.34
10	3.29	2.92	2.73	2.61	2.52	2.46	2.41	2.38	2.35	2.32	2.30	2.28	2.27	2.26	2.24
11	3.23	2.86	2.66	2.54	2.45	2.39	2.34	2.30	2.27	2.25	2.23	2.21	2.19	2.18	2.17
12	3.18	2.81	2.61	2.48	2.39	2.33	2.28	2.24	2.21	2.19	2.17	2.15	2.13	2.12	2.10
13	3.14	2.76	2.56	2.43	2.35	2.28	2.23	2.20	2.16	2.14	2.12	2.10	2.08	2.07	2.05
14	3.10	2.73	2.52	2.39	2.31	2.24	2.19	2.15	2.12	2.10	2.07	2.05	2.04	2.02	2.01
15	3.07	2.70	2.49	2.36	2.27	2.21	2.16	2.12	2.09	2.06	2.04	2.02	2.00	1.99	1.97
16	3.05	2.67	2.46	2.33	2.24	2.18	2.13	2.09	2.06	2.03	2.01	1.99	1.97	1.95	1.94
17	3.03	2.64	2.44	2.31	2.22	2.15	2.10	2.06	2.03	2.00	1.98	1.96	1.94	1.93	1.91
18	3.01	2.62	2.42	2.29	2.20	2.13	2.08	2.04	2.00	1.98	1.95	1.93	1.92	1.90	1.89
19	2.99	2.61	2.40	2.27	2.18	2.11	2.06	2.02	1.98	1.96	1.93	1.91	1.89	1.88	1.86
20	2.97	2.59	2.38	2.25	2.16	2.09	2.04	2.00	1.96	1.94	1.91	1.89	1.87	1.86	1.84
21	2.96	2.57	2.36	2.23	2.14	2.08	2.02	1.98	1.95	1.92	1.90	1.87	1.86	1.84	1.83
22	2.95	2.56	2.35	2.22	2.13	2.06	2.01	1.97	1.93	1.90	1.88	1.86	1.84	1.83	1.81
23	2.94	2.55	2.34	2.21	2.11	2.05	1.99	1.95	1.92	1.89	1.87	1.84	1.83	1.81	1.80
24	2.93	2.54	2.33	2.19	2.10	2.04	1.98	1.94	1.91	1.88	1.85	1.83	1.81	1.80	1.78
25	2.92	2.53	2.32	2.18	2.09	2.02	1.97	1.93	1.89	1.87	1.84	1.82	1.80	1.79	1.77
30	2.88	2.49	2.28	2.14	2.05	1.98	1.93	1.88	1.85	1.82	1.79	1.77	1.75	1.74	1.72
40	2.84	2.44	2.23	2.09	2.00	1.93	1.87	1.83	1.79	1.76	1.74	1.71	1.70	1.68	1.66
60	2.79	2.39	2.18	2.04	1.95	1.87	1.82	1.77	1.74	1.71	1.68	1.66	1.64	1.62	1.60
120	2.75	2.35	2.13	1.99	1.90	1.82	1.77	1.72	1.68	1.65	1.63	1.60	1.58	1.56	1.55



Table of the F-Distribution

Critical values for right-hand tail area equal to **0.10**

df1:	16	17	18	19	20	21	22	23	24	25	30	40	50	60	120
df2: 1	61.3	61.5	61.6	61.7	61.7	61.8	61.9	61.9	62.0	62.1	62.3	62.5	62.7	62.8	63.1
2	9.43	9.43	9.44	9.44	9.44	9.44	9.45	9.45	9.45	9.45	9.46	9.47	9.47	9.47	9.48
3	5.20	5.19	5.19	5.19	5.18	5.18	5.18	5.18	5.18	5.17	5.17	5.16	5.15	5.15	5.14
4	3.86	3.86	3.85	3.85	3.84	3.84	3.84	3.83	3.83	3.83	3.82	3.80	3.80	3.79	3.78
5	3.23	3.22	3.22	3.21	3.21	3.20	3.20	3.19	3.19	3.19	3.17	3.16	3.15	3.14	3.12
6	2.86	2.85	2.85	2.84	2.84	2.83	2.83	2.82	2.82	2.81	2.80	2.78	2.77	2.76	2.74
7	2.62	2.61	2.61	2.60	2.59	2.59	2.58	2.58	2.58	2.57	2.56	2.54	2.52	2.51	2.49
8	2.45	2.45	2.44	2.43	2.42	2.42	2.41	2.41	2.40	2.40	2.38	2.36	2.35	2.34	2.32
9	2.33	2.32	2.31	2.30	2.30	2.29	2.29	2.28	2.28	2.27	2.25	2.23	2.22	2.21	2.18
10	2.23	2.22	2.22	2.21	2.20	2.19	2.19	2.18	2.18	2.17	2.16	2.13	2.12	2.11	2.08
11	2.16	2.15	2.14	2.13	2.12	2.12	2.11	2.11	2.10	2.10	2.08	2.05	2.04	2.03	2.00
12	2.09	2.08	2.08	2.07	2.06	2.05	2.05	2.04	2.04	2.03	2.01	1.99	1.97	1.96	1.93
13	2.04	2.03	2.02	2.01	2.01	2.00	1.99	1.99	1.98	1.98	1.96	1.93	1.92	1.90	1.88
14	2.00	1.99	1.98	1.97	1.96	1.96	1.95	1.94	1.94	1.93	1.91	1.89	1.87	1.86	1.83
15	1.96	1.95	1.94	1.93	1.92	1.92	1.91	1.90	1.90	1.89	1.87	1.85	1.83	1.82	1.79
16	1.93	1.92	1.91	1.90	1.89	1.88	1.88	1.87	1.87	1.86	1.84	1.81	1.79	1.78	1.75
17	1.90	1.89	1.88	1.87	1.86	1.86	1.85	1.84	1.84	1.83	1.81	1.78	1.76	1.75	1.72
18	1.87	1.86	1.85	1.84	1.84	1.83	1.82	1.82	1.81	1.80	1.78	1.75	1.74	1.72	1.69
19	1.85	1.84	1.83	1.82	1.81	1.81	1.80	1.79	1.79	1.78	1.76	1.73	1.71	1.70	1.67
20	1.83	1.82	1.81	1.80	1.79	1.79	1.78	1.77	1.77	1.76	1.74	1.71	1.69	1.68	1.64
21	1.81	1.80	1.79	1.78	1.78	1.77	1.76	1.75	1.75	1.74	1.72	1.69	1.67	1.66	1.62
22	1.80	1.79	1.78	1.77	1.76	1.75	1.74	1.74	1.73	1.73	1.70	1.67	1.65	1.64	1.60
23	1.78	1.77	1.76	1.75	1.74	1.74	1.73	1.72	1.72	1.71	1.69	1.66	1.64	1.62	1.59
24	1.77	1.76	1.75	1.74	1.73	1.72	1.71	1.71	1.70	1.70	1.67	1.64	1.62	1.61	1.57
25	1.76	1.75	1.74	1.73	1.72	1.71	1.70	1.70	1.69	1.68	1.66	1.63	1.61	1.59	1.56
30	1.71	1.70	1.69	1.68	1.67	1.66	1.65	1.64	1.64	1.63	1.61	1.57	1.55	1.54	1.50
40	1.65	1.64	1.62	1.61	1.61	1.60	1.59	1.58	1.57	1.57	1.54	1.51	1.48	1.47	1.42
60	1.59	1.58	1.56	1.55	1.54	1.53	1.53	1.52	1.51	1.50	1.48	1.44	1.41	1.40	1.35
120	1.53	1.52	1.50	1.49	1.48	1.47	1.46	1.46	1.45	1.44	1.41	1.37	1.34	1.32	1.26



Table of the F-Distribution

Critical values for right-hand tail area equal to **0.05**

df1:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
df2: 1	161	200	216	225	230	234	237	239	241	242	243	244	245	245	246
2	18.5	19.0	19.2	19.2	19.3	19.3	19.4	19.4	19.4	19.4	19.4	19.4	19.4	19.4	19.4
3	10.1	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79	8.76	8.74	8.73	8.71	8.70
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96	5.94	5.91	5.89	5.87	5.86
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74	4.70	4.68	4.66	4.64	4.62
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06	4.03	4.00	3.98	3.96	3.94
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64	3.60	3.57	3.55	3.53	3.51
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35	3.31	3.28	3.26	3.24	3.22
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14	3.10	3.07	3.05	3.03	3.01
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98	2.94	2.91	2.89	2.86	2.85
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.85	2.82	2.79	2.76	2.74	2.72
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75	2.72	2.69	2.66	2.64	2.62
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67	2.63	2.60	2.58	2.55	2.53
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65	2.60	2.57	2.53	2.51	2.48	2.46
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59	2.54	2.51	2.48	2.45	2.42	2.40
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49	2.46	2.42	2.40	2.37	2.35
17	4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.49	2.45	2.41	2.38	2.35	2.33	2.31
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41	2.37	2.34	2.31	2.29	2.27
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42	2.38	2.34	2.31	2.28	2.26	2.23
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39	2.35	2.31	2.28	2.25	2.22	2.20
21	4.32	3.47	3.07	2.84	2.68	2.57	2.49	2.42	2.37	2.32	2.28	2.25	2.22	2.20	2.18
22	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34	2.30	2.26	2.23	2.20	2.17	2.15
23	4.28	3.42	3.03	2.80	2.64	2.53	2.44	2.37	2.32	2.27	2.24	2.20	2.18	2.15	2.13
24	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30	2.25	2.22	2.18	2.15	2.13	2.11
25	4.24	3.39	2.99	2.76	2.60	2.49	2.40	2.34	2.28	2.24	2.20	2.16	2.14	2.11	2.09
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.16	2.13	2.09	2.06	2.04	2.01
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.08	2.04	2.00	1.97	1.95	1.92
60	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04	1.99	1.95	1.92	1.89	1.86	1.84
120	3.92	3.07	2.68	2.45	2.29	2.18	2.09	2.02	1.96	1.91	1.87	1.83	1.80	1.78	1.75



Table of the F-Distribution

Critical values for right-hand tail area equal to **0.05**

df1:	16	17	18	19	20	21	22	23	24	25	30	40	50	60	120
df2: 1	246	247	247	248	248	248	249	249	249	249	250	251	252	252	253
2	19.4	19.4	19.4	19.4	19.4	19.4	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5
3	8.69	8.68	8.67	8.67	8.66	8.65	8.65	8.64	8.64	8.63	8.62	8.59	8.58	8.57	8.55
4	5.84	5.83	5.82	5.81	5.80	5.79	5.79	5.78	5.77	5.77	5.75	5.72	5.70	5.69	5.66
5	4.60	4.59	4.58	4.57	4.56	4.55	4.54	4.53	4.53	4.52	4.50	4.46	4.44	4.43	4.40
6	3.92	3.91	3.90	3.88	3.87	3.86	3.86	3.85	3.84	3.83	3.81	3.77	3.75	3.74	3.70
7	3.49	3.48	3.47	3.46	3.44	3.43	3.43	3.42	3.41	3.40	3.38	3.34	3.32	3.30	3.27
8	3.20	3.19	3.17	3.16	3.15	3.14	3.13	3.12	3.12	3.11	3.08	3.04	3.02	3.01	2.97
9	2.99	2.97	2.96	2.95	2.94	2.93	2.92	2.91	2.90	2.89	2.86	2.83	2.80	2.79	2.75
10	2.83	2.81	2.80	2.79	2.77	2.76	2.75	2.75	2.74	2.73	2.70	2.66	2.64	2.62	2.58
11	2.70	2.69	2.67	2.66	2.65	2.64	2.63	2.62	2.61	2.60	2.57	2.53	2.51	2.49	2.45
12	2.60	2.58	2.57	2.56	2.54	2.53	2.52	2.51	2.51	2.50	2.47	2.43	2.40	2.38	2.34
13	2.51	2.50	2.48	2.47	2.46	2.45	2.44	2.43	2.42	2.41	2.38	2.34	2.31	2.30	2.25
14	2.44	2.43	2.41	2.40	2.39	2.38	2.37	2.36	2.35	2.34	2.31	2.27	2.24	2.22	2.18
15	2.38	2.37	2.35	2.34	2.33	2.32	2.31	2.30	2.29	2.28	2.25	2.20	2.18	2.16	2.11
16	2.33	2.32	2.30	2.29	2.28	2.26	2.25	2.24	2.24	2.23	2.19	2.15	2.12	2.11	2.06
17	2.29	2.27	2.26	2.24	2.23	2.22	2.21	2.20	2.19	2.18	2.15	2.10	2.08	2.06	2.01
18	2.25	2.23	2.22	2.20	2.19	2.18	2.17	2.16	2.15	2.14	2.11	2.06	2.04	2.02	1.97
19	2.21	2.20	2.18	2.17	2.16	2.14	2.13	2.12	2.11	2.11	2.07	2.03	2.00	1.98	1.93
20	2.18	2.17	2.15	2.14	2.12	2.11	2.10	2.09	2.08	2.07	2.04	1.99	1.97	1.95	1.90
21	2.16	2.14	2.12	2.11	2.10	2.08	2.07	2.06	2.05	2.05	2.01	1.96	1.94	1.92	1.87
22	2.13	2.11	2.10	2.08	2.07	2.06	2.05	2.04	2.03	2.02	1.98	1.94	1.91	1.89	1.84
23	2.11	2.09	2.08	2.06	2.05	2.04	2.02	2.01	2.01	2.00	1.96	1.91	1.88	1.86	1.81
24	2.09	2.07	2.05	2.04	2.03	2.01	2.00	1.99	1.98	1.97	1.94	1.89	1.86	1.84	1.79
25	2.07	2.05	2.04	2.02	2.01	2.00	1.98	1.97	1.96	1.96	1.92	1.87	1.84	1.82	1.77
30	1.99	1.98	1.96	1.95	1.93	1.92	1.91	1.90	1.89	1.88	1.84	1.79	1.76	1.74	1.68
40	1.90	1.89	1.87	1.85	1.84	1.83	1.81	1.80	1.79	1.78	1.74	1.69	1.66	1.64	1.58
60	1.82	1.80	1.78	1.76	1.75	1.73	1.72	1.71	1.70	1.69	1.65	1.59	1.56	1.53	1.47
120	1.73	1.71	1.69	1.67	1.66	1.64	1.63	1.62	1.61	1.60	1.55	1.50	1.46	1.43	1.35



Table of the F-Distribution

Critical values for right-hand tail area equal to **0.025**

df1:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
df2: 1	648	800	864	900	922	937	948	957	963	969	973	977	980	983	985
2	38.5	39.0	39.2	39.2	39.3	39.3	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4
3	17.4	16.0	15.4	15.1	14.9	14.7	14.6	14.5	14.5	14.4	14.4	14.3	14.3	14.3	14.3
4	12.2	10.6	9.98	9.60	9.36	9.20	9.07	8.98	8.90	8.84	8.79	8.75	8.71	8.68	8.66
5	10.0	8.43	7.76	7.39	7.15	6.98	6.85	6.76	6.68	6.62	6.57	6.52	6.49	6.46	6.43
6	8.81	7.26	6.60	6.23	5.99	5.82	5.70	5.60	5.52	5.46	5.41	5.37	5.33	5.30	5.27
7	8.07	6.54	5.89	5.52	5.29	5.12	4.99	4.90	4.82	4.76	4.71	4.67	4.63	4.60	4.57
8	7.57	6.06	5.42	5.05	4.82	4.65	4.53	4.43	4.36	4.30	4.24	4.20	4.16	4.13	4.10
9	7.21	5.71	5.08	4.72	4.48	4.32	4.20	4.10	4.03	3.96	3.91	3.87	3.83	3.80	3.77
10	6.94	5.46	4.83	4.47	4.24	4.07	3.95	3.85	3.78	3.72	3.66	3.62	3.58	3.55	3.52
11	6.72	5.26	4.63	4.28	4.04	3.88	3.76	3.66	3.59	3.53	3.47	3.43	3.39	3.36	3.33
12	6.55	5.10	4.47	4.12	3.89	3.73	3.61	3.51	3.44	3.37	3.32	3.28	3.24	3.21	3.18
13	6.41	4.97	4.35	4.00	3.77	3.60	3.48	3.39	3.31	3.25	3.20	3.15	3.12	3.08	3.05
14	6.30	4.86	4.24	3.89	3.66	3.50	3.38	3.29	3.21	3.15	3.09	3.05	3.01	2.98	2.95
15	6.20	4.77	4.15	3.80	3.58	3.41	3.29	3.20	3.12	3.06	3.01	2.96	2.92	2.89	2.86
16	6.12	4.69	4.08	3.73	3.50	3.34	3.22	3.12	3.05	2.99	2.93	2.89	2.85	2.82	2.79
17	6.04	4.62	4.01	3.66	3.44	3.28	3.16	3.06	2.98	2.92	2.87	2.82	2.79	2.75	2.72
18	5.98	4.56	3.95	3.61	3.38	3.22	3.10	3.01	2.93	2.87	2.81	2.77	2.73	2.70	2.67
19	5.92	4.51	3.90	3.56	3.33	3.17	3.05	2.96	2.88	2.82	2.76	2.72	2.68	2.65	2.62
20	5.87	4.46	3.86	3.51	3.29	3.13	3.01	2.91	2.84	2.77	2.72	2.68	2.64	2.60	2.57
21	5.83	4.42	3.82	3.48	3.25	3.09	2.97	2.87	2.80	2.73	2.68	2.64	2.60	2.56	2.53
22	5.79	4.38	3.78	3.44	3.22	3.05	2.93	2.84	2.76	2.70	2.65	2.60	2.56	2.53	2.50
23	5.75	4.35	3.75	3.41	3.18	3.02	2.90	2.81	2.73	2.67	2.62	2.57	2.53	2.50	2.47
24	5.72	4.32	3.72	3.38	3.15	2.99	2.87	2.78	2.70	2.64	2.59	2.54	2.50	2.47	2.44
25	5.69	4.29	3.69	3.35	3.13	2.97	2.85	2.75	2.68	2.61	2.56	2.51	2.48	2.44	2.41
30	5.57	4.18	3.59	3.25	3.03	2.87	2.75	2.65	2.57	2.51	2.46	2.41	2.37	2.34	2.31
40	5.42	4.05	3.46	3.13	2.90	2.74	2.62	2.53	2.45	2.39	2.33	2.29	2.25	2.21	2.18
60	5.29	3.93	3.34	3.01	2.79	2.63	2.51	2.41	2.33	2.27	2.22	2.17	2.13	2.09	2.06
120	5.15	3.80	3.23	2.89	2.67	2.52	2.39	2.30	2.22	2.16	2.10	2.05	2.01	1.98	1.94



Table of the F-Distribution

Critical values for right-hand tail area equal to **0.025**

df1:	16	17	18	19	20	21	22	23	24	25	30	40	50	60	120
df2: 1	987	989	990	992	993	994	995	996	997	998	1001	1006	1008	1010	1014
2	39.4	39.4	39.4	39.4	39.4	39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5
3	14.2	14.2	14.2	14.2	14.2	14.2	14.1	14.1	14.1	14.1	14.1	14.0	14.0	14.0	13.9
4	8.63	8.61	8.59	8.58	8.56	8.55	8.53	8.52	8.51	8.50	8.46	8.41	8.38	8.36	8.31
5	6.40	6.38	6.36	6.34	6.33	6.31	6.30	6.29	6.28	6.27	6.23	6.18	6.14	6.12	6.07
6	5.24	5.22	5.20	5.18	5.17	5.15	5.14	5.13	5.12	5.11	5.07	5.01	4.98	4.96	4.90
7	4.54	4.52	4.50	4.48	4.47	4.45	4.44	4.43	4.41	4.40	4.36	4.31	4.28	4.25	4.20
8	4.08	4.05	4.03	4.02	4.00	3.98	3.97	3.96	3.95	3.94	3.89	3.84	3.81	3.78	3.73
9	3.74	3.72	3.70	3.68	3.67	3.65	3.64	3.63	3.61	3.60	3.56	3.51	3.47	3.45	3.39
10	3.50	3.47	3.45	3.44	3.42	3.40	3.39	3.38	3.37	3.35	3.31	3.26	3.22	3.20	3.14
11	3.30	3.28	3.26	3.24	3.23	3.21	3.20	3.18	3.17	3.16	3.12	3.06	3.03	3.00	2.94
12	3.15	3.13	3.11	3.09	3.07	3.06	3.04	3.03	3.02	3.01	2.96	2.91	2.87	2.85	2.79
13	3.03	3.00	2.98	2.96	2.95	2.93	2.92	2.91	2.89	2.88	2.84	2.78	2.74	2.72	2.66
14	2.92	2.90	2.88	2.86	2.84	2.83	2.81	2.80	2.79	2.78	2.73	2.67	2.64	2.61	2.55
15	2.84	2.81	2.79	2.77	2.76	2.74	2.73	2.71	2.70	2.69	2.64	2.59	2.55	2.52	2.46
16	2.76	2.74	2.72	2.70	2.68	2.67	2.65	2.64	2.63	2.61	2.57	2.51	2.47	2.45	2.38
17	2.70	2.67	2.65	2.63	2.62	2.60	2.59	2.57	2.56	2.55	2.50	2.44	2.41	2.38	2.32
18	2.64	2.62	2.60	2.58	2.56	2.54	2.53	2.52	2.50	2.49	2.44	2.38	2.35	2.32	2.26
19	2.59	2.57	2.55	2.53	2.51	2.49	2.48	2.46	2.45	2.44	2.39	2.33	2.30	2.27	2.20
20	2.55	2.52	2.50	2.48	2.46	2.45	2.43	2.42	2.41	2.40	2.35	2.29	2.25	2.22	2.16
21	2.51	2.48	2.46	2.44	2.42	2.41	2.39	2.38	2.37	2.36	2.31	2.25	2.21	2.18	2.11
22	2.47	2.45	2.43	2.41	2.39	2.37	2.36	2.34	2.33	2.32	2.27	2.21	2.17	2.14	2.08
23	2.44	2.42	2.39	2.37	2.36	2.34	2.33	2.31	2.30	2.29	2.24	2.18	2.14	2.11	2.04
24	2.41	2.39	2.36	2.35	2.33	2.31	2.30	2.28	2.27	2.26	2.21	2.15	2.11	2.08	2.01
25	2.38	2.36	2.34	2.32	2.30	2.28	2.27	2.26	2.24	2.23	2.18	2.12	2.08	2.05	1.98
30	2.28	2.26	2.23	2.21	2.20	2.18	2.16	2.15	2.14	2.12	2.07	2.01	1.97	1.94	1.87
40	2.15	2.13	2.11	2.09	2.07	2.05	2.03	2.02	2.01	1.99	1.94	1.88	1.83	1.80	1.72
60	2.03	2.01	1.98	1.96	1.94	1.93	1.91	1.90	1.88	1.87	1.82	1.74	1.70	1.67	1.58
120	1.92	1.89	1.87	1.84	1.82	1.81	1.79	1.77	1.76	1.75	1.69	1.61	1.56	1.53	1.43



Table of Durbin-Watson Test Statistic Critical Values

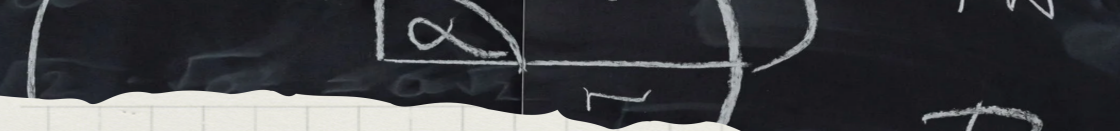
1 Per Cent Significance Points of dL and dU

	k = 1		k = 2		k = 3		k = 4	
n	dL	dU	dL	dU	dL	dU	dL	dU
6	0.390	1.142	-----	-----	-----	-----	-----	-----
7	0.435	1.036	0.294	1.676	-----	-----	-----	-----
8	0.497	1.003	0.345	1.489	0.229	2.102	-----	-----
9	0.554	0.998	0.408	1.389	0.279	1.875	0.183	2.433
10	0.604	1.001	0.466	1.333	0.340	1.733	0.230	2.193
11	0.653	1.010	0.519	1.297	0.396	1.640	0.286	2.030
12	0.697	1.023	0.569	1.274	0.449	1.575	0.339	1.913
13	0.738	1.038	0.616	1.261	0.499	1.526	0.391	1.826
14	0.776	1.054	0.660	1.254	0.547	1.490	0.441	1.757
15	0.811	1.070	0.700	1.252	0.591	1.465	0.487	1.705
16	0.844	1.086	0.738	1.253	0.633	1.447	0.532	1.664
17	0.873	1.102	0.773	1.255	0.672	1.432	0.574	1.631
18	0.902	1.118	0.805	1.259	0.708	1.422	0.614	1.604
19	0.928	1.133	0.835	1.264	0.742	1.416	0.650	1.583
20	0.952	1.147	0.862	1.270	0.774	1.410	0.684	1.567
21	0.975	1.161	0.889	1.276	0.803	1.408	0.718	1.554
22	0.997	1.174	0.915	1.284	0.832	1.407	0.748	1.543
23	1.017	1.186	0.938	1.290	0.858	1.407	0.777	1.535
24	1.037	1.199	0.959	1.298	0.881	1.407	0.805	1.527
25	1.055	1.210	0.981	1.305	0.906	1.408	0.832	1.521
26	1.072	1.222	1.000	1.311	0.928	1.410	0.855	1.517
27	1.088	1.232	1.019	1.318	0.948	1.413	0.878	1.514
28	1.104	1.244	1.036	1.325	0.969	1.414	0.901	1.512
29	1.119	1.254	1.053	1.332	0.988	1.418	0.921	1.511
30	1.134	1.264	1.070	1.339	1.006	1.421	0.941	1.510
40	1.246	1.344	1.197	1.398	1.149	1.456	1.098	1.518
45	1.288	1.376	1.245	1.424	1.201	1.474	1.156	1.528
50	1.324	1.403	1.285	1.445	1.245	1.491	1.206	1.537
55	1.356	1.428	1.320	1.466	1.284	1.505	1.246	1.548
60	1.382	1.449	1.351	1.484	1.317	1.520	1.283	1.559
65	1.407	1.467	1.377	1.500	1.346	1.534	1.314	1.568
70	1.429	1.485	1.400	1.514	1.372	1.546	1.343	1.577
75	1.448	1.501	1.422	1.529	1.395	1.557	1.368	1.586
80	1.465	1.514	1.440	1.541	1.416	1.568	1.390	1.595
85	1.481	1.529	1.458	1.553	1.434	1.577	1.411	1.603
90	1.496	1.541	1.474	1.563	1.452	1.587	1.429	1.611
95	1.510	1.552	1.489	1.573	1.468	1.596	1.446	1.618
100	1.522	1.562	1.502	1.582	1.482	1.604	1.461	1.625

Table of Durbin-Watson Test Statistic Critical Values

5 Per Cent Significance Points of dL and dU

	k = 1		k = 2		k = 3		k = 4	
n	dL	dU	dL	dU	dL	dU	dL	dU
6	0.610	1.400	-----	-----	-----	-----	-----	-----
7	0.700	1.356	0.467	1.896	-----	-----	-----	-----
8	0.763	1.332	0.559	1.777	0.367	2.287	-----	-----
9	0.824	1.320	0.629	1.699	0.455	2.128	0.296	2.588
10	0.879	1.320	0.697	1.641	0.525	2.016	0.376	2.414
11	0.927	1.324	0.758	1.604	0.595	1.928	0.444	2.283
12	0.971	1.331	0.812	1.579	0.658	1.864	0.512	2.177
13	1.010	1.340	0.861	1.562	0.715	1.816	0.574	2.094
14	1.045	1.350	0.905	1.551	0.767	1.779	0.632	2.030
15	1.077	1.361	0.946	1.543	0.814	1.750	0.685	1.977
16	1.106	1.371	0.982	1.539	0.857	1.728	0.734	1.935
17	1.133	1.381	1.015	1.536	0.897	1.710	0.779	1.900
18	1.158	1.391	1.046	1.535	0.933	1.696	0.820	1.872
19	1.180	1.401	1.074	1.536	0.967	1.685	0.859	1.848
20	1.201	1.411	1.100	1.537	0.998	1.676	0.894	1.828
21	1.221	1.420	1.125	1.538	1.026	1.669	0.927	1.812
22	1.239	1.429	1.147	1.541	1.053	1.664	0.958	1.797
23	1.257	1.437	1.168	1.543	1.078	1.660	0.986	1.785
24	1.273	1.446	1.188	1.546	1.101	1.656	1.013	1.775
25	1.288	1.454	1.206	1.550	1.123	1.654	1.038	1.767
26	1.302	1.461	1.224	1.553	1.143	1.652	1.062	1.759
27	1.316	1.469	1.240	1.556	1.162	1.651	1.084	1.753
28	1.328	1.476	1.255	1.560	1.181	1.650	1.104	1.747
29	1.341	1.483	1.270	1.563	1.198	1.650	1.124	1.743
30	1.352	1.489	1.284	1.567	1.214	1.650	1.143	1.739
40	1.442	1.544	1.391	1.600	1.338	1.659	1.285	1.721
45	1.475	1.566	1.430	1.615	1.383	1.666	1.336	1.720
50	1.503	1.585	1.462	1.628	1.421	1.674	1.378	1.721
55	1.528	1.601	1.490	1.641	1.452	1.681	1.414	1.724
60	1.549	1.616	1.514	1.652	1.480	1.689	1.444	1.727
65	1.567	1.629	1.536	1.662	1.503	1.696	1.471	1.731
70	1.583	1.641	1.554	1.672	1.525	1.703	1.494	1.735
75	1.598	1.652	1.571	1.680	1.543	1.709	1.515	1.739
80	1.611	1.662	1.586	1.688	1.560	1.715	1.534	1.743
85	1.624	1.671	1.600	1.696	1.575	1.721	1.550	1.747
90	1.635	1.679	1.612	1.703	1.589	1.726	1.566	1.751
95	1.645	1.687	1.623	1.709	1.602	1.732	1.579	1.755
100	1.654	1.694	1.634	1.715	1.613	1.736	1.592	1.758



Developed by Jonathan Lambert @ National College of Ireland (2026)

ISBN: 978-0-905957-50-0