MATLAB FUNCTIONS AND SCRIPT FILES

Richard E. Strauss
Biological Sciences, Texas Tech University

http://www.faculty.biol.ttu.edu/Strauss/Matlab/matlab.htm

Note: I am gradually converting function names to the standardized form AaaBbbCcc to avoid conflicts with Matlab in-line functions, but it's taking some time.

CONSTANTS

phi	The golden proportion

CREATION OF SPECIAL MATRICES

design	Creates a GLM design matrix
Helmert	Creates a Helmert orthogonal-contrast matrix
makegrps	Composes a group membership vector from group labels and frequencies
MakeFactorLevels	Composes a group-membership matrix of factor levels for a balanced N-way anova
makerepeatseqs	Generates vector of [1,2,...,n, 1,2,...,n, ...]'

KINDS OF MATRICES

isblank	Determines whether character matrix consists of all blanks
iscorr	Determines whether matrix is in form of a correlation matrix
iscov	Determines whether matrix is in form of a covariance matrix
isdist	Determines whether matrix is in form of a distance matrix
iseven	Determines whether matrix elements are all even integers
isin	Finds elements of matrix A contained within matrix B
isintegr	Determines whether matrix is all integers
ismatrix	Determines whether matrix is at least 2-dimensional
ismonotonic	Determines whether columns of matrix are monotonic
isodd	Determines whether matrix elements are all odd integers
isposdef	Determines whether square symmetric matrix is positive-definite
isscalar	Determines whether matrix is a scalar
issorted	Determines whether matrix cols are sorted
issqsym	Determines whether matrix is square symmetric
isvect	Determines whether matrix is a vector; also returns size

NUMERICAL OPERATIONS

baseconv	Convert numeric vector to single base10 values
complex	Convert two column real matrix to complex
design	Creates GLM design matrix
distance	Convert points to distances, given specifications
grpcentr	Zero-centers the columns of data matrix, by group
logtimesample	Log-uniform series of sampling dates
makerepeatseqs	Generates vector of [1,2,...,n, 1,2,...,n, ...]'
meanwtcenter	Weighted mean of X based on deviations from center of y
prbcount	Vector of counts from a vector of probabilities
rankdistmean	Ranks of absolute deviations from the mean, by group
RankCols	Ranks of data by column, optionally by group
reassign	Reassign labels of vector to maximize matches with second vector
rowmean	Returns column vector of row means, optionally ignoring missing data
rowsum	Returns column vector of row sums, optionally ignoring

	missing data
setrange	Rescales ranges, by column, given min and max values
subgrpadj	Adjusts subgroup means to grand mean within group
sumsqscale	Scales columns so that the squared elements sum to unity
sweep	Sweep operator for symmetric matrices
todegs	Converts radians to degrees
torads	Converts degrees to radians
zcenter	Zero-centers data matrix by column
zscore	Standardizes columns of data matrix

UNIVARIATE STATISTICAL ANALYSES

absdev	Converts data matrix to absolute deviations from mean or median
anova	One-way unbalanced fixed-effects ANOVA, with variance components
anovaf	Objective function for 'anova'
AnovaIsotonic	Isotonic ANOVA to test for ordered group means
anovanst	Two-level nested random-effects ANOVA, with variance components
anovanstf	Objective function for 'anovanst'
anovanstg	Design matrices for 'anovanst'
anovaparam	One-way unbalanced anova, given only means, stdevs, and sample sizes
anovast	One-way unbalanced ANOVA of statistic estimates & stderrs
asymmeas	Palmer-Strobeck anova model for fluctuating asymmetry
BinomPropTest	Single-sample test of observed binomial proportion against null proportion
censoredregr	Tobit model for censored regression
censoredstats	Mean, stdev and their standard errors for censored data
chi2comb	Combines chi-squared values to give a single p-value
chi2corr	Chi-square distances among columns of contingency table
CircularStats	Mean and concentration (inverse variance) for circular data
cisignif	Pairwise differences based on means and confidence intervals only
contin1	Randomized 1-way chi-square goodness-of-fit test
ContingencyTable2Way	Randomized 2-way contingency table analysis, fixed or free marginals
continex	Fisher's exact test for [2x2] contingency table
cummean	Cumulative means and variances
DichotBinomPower	Calculates power of test for difference in binomial probability from null value of 0.5.
fratio	Randomized F ratio test for equal variances
GoodFitPowerDiverge	Power divergence chi-squared goodness-of-fit test
GoodFitMse	Edgington's permutation mse goodness-of-fit test
gtest	2-way log-likelihood contingency table test
histplot	Matrix of histograms
HomoSubsets	Homogeneous subsets from a symmetric binary matrix of signif diffs
kruskwal	Randomized Kruskal-Wallace (& Mann-Whitney) test for 2+ samples
ksprob	Significance level for Kolmogorov-Smirnov test
kstest1	1-sample randomized Kolmogorov-Smirnov test
kstest1f	Objective function for kstest1
KsTest2Sample	2-sample randomized Kolmogorov-Smirnov test
KsTest2SampleObj	Objective function for kstest2
kwcrit	Critical values for the Kruskal-Wallace statistic, given sample sizes
kwstat	Kruskal-Wallace test-statistic value
levene	Levene's test: anova of absolute deviations from the means

logb	Logarithm of x to base b
mannprob	Tail probability for the Mann-Whitney statistic
mannwhit	2-group 2-tailed Mann-Whitney test for group differences
mannwhf	Objective function for mannwhit
means	Means by column (even for row vectors), optionally by group
meanwt	Weighted mean, variance, skewness, kurtosis
medians	Medians by column (even for row vectors), optionally by group
MinEffectTest	Performs a minimum-effect hypothesis test based on an F-statistic
MinObsProb	Given a probability of occurrence, finds min sample size
mode	Finds mode by over-binning
negbino	Fits negative binomial distribution to matrix of quadrat counts
normaltest	Shapiro-Francia test for normality
nscores	Normal (phi) scores
orderstats	Means and covar matrix of normal order statistics
pairwise	Overall and pairwise anova/Kruskal-Wallace tests, randomized
PowerF	Estimates power from F-statistic
PowerPV	Estimates power from variance accounted for by effect
prctilerange	Percentile range
Percentiles	Finds percentiles of a distribution by linear interpolation
probdetect	Estimates probability of detecting one or more binomial events
probzero	probability of observing 0 of N 'successes'
PropDiff	Randomization test for difference in two proportions
rankasgn	Ranks of single data vector, invoking midrank ties
rankits	Expected normal scores for an ordered random sample
RankCols	Ranks of data by column, optionally within-group
ratioprob	Tests a sex ratio against the null of unity
richnessdiff	Tests for pairwise differences in 'richness' (numbers of unique objects)
seqbonf	Sequential Bonferroni test on a set of probabilities
subgrpadj	Adjusts subgroup means to grand mean within group
subgrpmeans	Tables of cell sample sizes and means for subgroups within groups
sums	Sums by column (even for row vectors), optionally by group
TrimmedMean	Trimmed mean as function of trimming proportion
truncate	Truncates (fixes) a matrix to a specified number of decimal places
ttest	Pairwise unbalanced t-tests among two or more groups
TtestOne	Single-sample t-test
ttestpr	Paired t-test, with control as covariate
ttestparam	Unbalanced t-test, given only means, stdevs, and sample sizes
tval	2-sample t-statistic, unequal sample sizes
varcomp	Variance components from a nested ANOVA, unequal sample sizes
UnivarStats	Moment and median statistics, allowing for missing data
wilcoxon	Wilcoxon 1-sample signed-Ranks test

REGRESSION

accumcurve	Accumulation curve and predicted saturation asymptote
AllomFit	Fit of bivariate allometry by log-linear and nonlinear regr
ancovpred	Predicted values per group under a common-slope ancova model
bilinear	Fits a bilinear segmented regression model
bilinearf	Objective function for 'bilinear'
bilintrans	Fits a transitional bilinear segmented regression model
bilintransf	Objective function for 'bilintrans'

CensoredRegr	Tobit model for censored regression
charshape	Bivariate shape scores for characters
GrowthModelFit	Fits one or more growth models
GrowthModelFitFn	Objective function for GrowthModelFit
lineeqn	Slope and intercept from two points
linregr	Predictive bivariate linear regression
LoessFit	Locally weighted nonparametric regression (loess, =lowess)
logistic	Logistic regression
logistf	Objective function for 'logistic'
ltsregr	Least-trimmed-squares bivariate regression
majaxis	Major-axis regression
mse	MSE and Adjusted R2 for regression
orthogpolyinterp	Visually interprets variation in orthog poly coefficients
OrthogPolyRegr	Orthogonal polynomial regression
orthogpolyregre	Sums of squares for orthogonal polynomial regression
orthogpolyregrf	Objective function for orthogonal polynomial regression
orthogpolyregrp	Predicted values for orthogonal polynomial regression
PCRegression	Principal-components regression
probit	Probit regression of binary response on continuous 'dose' variable
probitf	Objective function for 'probit'
quadratic	Quadratic regression
r2adj	Adjustsed squared multiple correlation
RegrCompare	Randomized comparison of two or more linear regression lines
RegrNull	Significance of regression, given null beta0 & beta1
sweepreg	Multiple regression via the sweep operator, given means & covars
GrowthTrajectory	Fits and evaluates 1-5 parameter models of segmented trajectories

MULTIVARIATE STATISTICAL ANALYSES

allom	Converts size-vector loadings to multivariate allometric coeffs
allomtst	Tests for heterogeneity among within-group size vectors
autocorr	Lagged autocorrelations along matrix columns
autorank	Spearman rank autocorrelations along a vector or matrix columns
BootModelParams	Tests for significance difference of models by bootstrapping model parameters
brokestk	Number of significant eigenvalues based on broken-stick model
cancorr	Canonical correlation analysis
charshape	Bivariate shape scores for characters
classify	Reclassifies observations or classifies unknowns, based on Mahalanobis distances
corr	Pearson correlations among variables or between sets of variables
corrf	Objective function for 'corr'
corrci	Simultaneous confidence intervals for Pearson correlation
corrcmpl	Distances (1-corrcoef) among columns
Corresp	Correspondence analysis of tables of counts
CorrNearest	Finds the nearest proper correlation matrix to one that is not positive-definite
corrplot	Correlation-style matrix of •istogram plots
corrpool	Pooled within-group correlation matrix
corrprci	Individual probs and confidence intervals for correlation matrix
corrprob	Test of correlation matrix against H0:diagonal matrix
corrz	Fisher's z-transform (w/ Hotelling's correction) for correlations

covcorr	Rescales covariance matrix to correlation matrix + vector of stdevs
CovNearest	Finds the nearest proper covariance matrix to one that is not positive-definite
covpairwise	Covariance matrix when data matrix contains missing values
covpool	Pooled within-group covariance matrix
CremersV	Cremer's V measure of association between rows and columns of a 2-way contingency table
Dfa	Bootstrapped discriminant analysis
DfaResids	"Size-invariant" discriminant analysis
DiceIndex	Dice coefficient of similarity for binary data; optional distance
discrdet	Determinant and rank of B matrix as function of number of vars
distdiff	Test for within- vs among-group pairwise distances or similarities
eigen	Sorted, directed eigenvectors and eigenvalues of symmetric matrix
friedraf	Randomized Friedman-Rafesky test for unequal multivariate distribs
geneigen	Generalized eigen analysis for two square matrices
henze	Henze nearest-neighbor test for unequal multivariate distribs
homogen	Measures the homogeneity among variables for a data matrix
HullIsopleths	Finds isopleths of 2D points from nested sets of convex hulls
hullpeel	Finds percentiles of 2D points from nested sets of convex hulls
JaccardIndex	Jaccard coefficient of association (similarity)for binary data; optional distance.
krige	Predicts missing values in a spatial matrix using universal kriging
loadscrs	Calculates loadings and scores
MahalDist	Mahalanobis distances, confidence intervals, and significance levels
Mahal2Centroid	Mahalanobis distances of observations from a group centroid
mahalsf	Size-free Mahalanobis distances
majaxis	Major-axis regression
manova	One-way multivariate analysis of variance
Mantel	Mantel's test for association between symmetric distances matrices
MatchingIndex	Simple matching coefficient (similarity) for binary data; optional distance
matcond	Matrix condition based on rarification of vars or obs
condfactor	Modified condition factor of correlation or covariance matrix
morisita	Morisita's measure of dissimilarity between communities
morphint	Measures and assesses morphological integration (character suites)
mosimann	Calculates Mossiman ratio-independent size vector
NNAssoc	Nearest-neighbor test for pairwise spatial association within groups
partcorm	Partials a covariate from a correlation matrix
partcorr	Calculates partial correlations, or possible ranges of correlations
pcaconstr	PCA, constrained to be independent of a set of independent variables
pcaCorr	Bootstrapped PCA using correlation matrix
PcaCovar	Bootstrapped PCA using covariance matrix
pcacovb	Bootstrap objective function for 'pcacov'
PcaPlots	Standard scatter and vector plots from a PCA
pcoa	Principal coordinates analysis of a distance matrix
percdist	Percent-similarity distance measure

posdef	If matrix isn't positive-definite, finds closest corresponding matrix
rankcorr	Rank correlation (Pearson correlation of ranks)
renkonen	Renkenon's percent-similarity measure of association
score	Unstandardized factor scores for a subset of factors
sizevect	Within-group size vectors (PC1 coefficients)
sorensen	Sorensen's (Bray-Curtis) distance measure
spearman	Spearman's rank correlation, adj for ties, for two variables
StepDiscrim	Stepwise discriminant or size-free discriminant analyses
StepManova	Stepwise MANOVA probabilities of the results of 'stepdisc'
steprank	Finds the best subset of variables to reduce a singular matrix
sumsqdiff	Pairwise sum-of-squares distances, bootstrapped
varcomb	With missing data, Finds best combinations of vars and observations
vectcorr	Vector correlations among vectors or matrix columns
wright	Wright-style factor analysis of covariance/correlation matrix
factorp	Least-squares fit of general/primary factor
factorpf	Objective function for 'factorp'
factors	Least-squares fit of secondary factors
factorsp	Objective function for 'factors'
wrightbt	Bootstrap of Wright-style factor analysis from data matrix

MISSING DATA

IsMissing	Finds missing values in matrix
krige	Predicts missing values in a spatial matrix using universal kriging
misscheck	Checks for missing (non-finite) values in matrices
MissDistrib	Measures degree of nonrandom (nonuniform) distributions of missing data within matrix
MissEM	Estimates missing values, means, and covariances via EM algorithm
MissEmReg	
MissEval	Evaluates the effect of missing-value estimation on a matrix
MissPC	Estimates missing values via multiple regression on PCs
missim	Simulates effects of groups and suites on missing-value estimation
randmiss	Random missing values inserted into a matrix
varcomb	With missing data, finds best subsets of complete variables and observations

COMBINATORICS

allgrps	Returns a list of all possible groupings of N objects into k groups
allgrpf	Lists all possible groupings of N objects into k grps
allsizes	Returns list of sample-size decompositions of N into k groups
binmatno	Number of possible (0,1) element matrices, given row & col sums
catalan	Catalan numbers
comb	Number of combinations of n objects taken r at a time
combvals	Returns matrix containing all combinations of nCr
nndeterm	Training vectors and degree of determination of FF neural network
partion	Returns list of partitions of N linearly-spaced objects into k groups
partf	Recursive function to find partitions
permlist	Returns matrix containing all permutations
permnext	Returns lexicographically next permutation

GRAPHS, TREES, AND CLUSTER ANALYSIS

allclade	Probabilities of all possible clade sizes a for rooted tree
AncestorFunction	Converts from one type ancestor function to another
ancmove	Moves ancestor to final position in ancestor function
chi2clst	Chi-squared clustering of rows of 2-way contingency table
cladeprb	Probability of sampling a tree containing an observed clade
clstsupt	Finds cluster-support matrix from dendrogram topology matrix
cluster	Bootstraps a UPGMA dendrogram, giving measures of cluster support
contmap	Least-squares mapping of continuous chars onto a tree
contmape	Exact mapping (topology only, or topology + nonzero branch lengths)
contmapi	Iterative mapping (topology + one or more zero branch lengths)
contmapf	Objective function for iterative mapping
contmapdists	Mapping of frequency distribs of a single characters onto a tree
Cophenetic	Finds agreement between original and patristic distances
dendline	Allows the plotting of vertical lines connecting taxa on a dendrogram
dendplot	Plots dendrogram from topology matrix
gaptest	Gap test for difference between two or more convex clusters
kmeangrp	Varies k and evaluate k-means clustering for number of groups
kmeans	k-means clustering of n points into k clusters by min(sse)
knnclust	Finds the best partition of point coordinates by the kth nearest-neighbor clustering procedure
clustnum	Determines number of partition clusters based on Gabriel graphs
knnplot	Plots scatterplot or dendrogram for k-nearest neighbor clustering
lnktoanc	Coverts list of links (internodes) to ancestor function
minkvary	Maps continuous character onto a tree for varying Minkowski k
MSTree	Finds and plots the minimum spanning tree
mstclust	Finds 'significant' clusters based on randomized min-span trees
MSTreeDists	Finds patristic distances on minimum spanning tree
mstgrp	Finds groups by deleting longest edges of min-span tree
nngrp	Nearest-neighbor (single-linkage) distances among groups
natclust	Finds 'natural' clusters (Carmichael et al. 1968)
NeighborJoin	Neighbor-joining additive tree from a distance matrix
NormalMixtureFit	Fits the normal-mixture model for one or more variables
PatristicDistance	Calculates step-distance and patristic-distance matrices from an ancestor function
phyliptree	Plots maximum likelihood tree based on Phylip output
randindx	Adjusted Rand index for comparison of different data partitions
Reroot	Reroots an additive tree to a specified outgroup
ShortestPath	Shortest paths between nodes from an adjacency matrix
topoanc	Converts dendrogram topology matrix to cladogram ancestor function
topotips	Finds the terminal taxa within clusters from a topology matrix
treenum	Number of possible rooted and unrooted binary trees for N taxa
treeasym	Calculates Colless' I (asymmetry) for trees specified by Rohlf's M
treecoli	Calculates Colless' I (asymmetry) from the ancestor function
treedivd	Finds links and levels on tree, given the ancestor function

treelen	Minkowski tree lengths
treemanc	Recovers ancestor function from Rohlf's M
treeplot	Plots a tree given an ancestor function and optional branch lengths
TreeRoot	Reroots an additive tree by the 'min var of patristic distance' criterion
TreeRootFn	Finds optimal root position, given the tree and the outgroup
treetips	Finds the terminal taxa within a clade from an ancestor function
treevect	Recovers N-tuple from Rohlf's M
Upgma	UPGMA hierarchical cluster analysis of a distance matrix
visitadj	Visits connected vertices of graph via an adjacency matrix

GEOMETRIC OBJECTS

circcrds	Returns plotting coordinates for a specified circle
CirclePlot	Plots a circle of specified radius and center
circfit	Fits a circle to a scatter of points
circfitf	Objective function for 'circfit'
conic	Generates plots of conics
EllipseBound	Generates points along boundary of an ellipse
ellipsesize	Area and perimeter of an ellipse
ellipsesizef	Objective function for integration
LogSpiral	Generates plots of logarithmic spirals
polygon	Area, perimeter, and length of side of a regular polygon

DISTRIBUTIONS

BetaBinomLogLikelihood	Calculates log-likelihood for beta-binomial distribution
BetaBinomProbs	Calculates pdf of beta-binomial distribution
bimodal	Coefficient of bimodality of a distribution, based on kurtosis; see also Multimodality.
binofit	Fits binomial distribution by minimizing the mean squared error
binofitf	Objective function for 'binofit'
BinomOverdispersionFit	Fits and tests the beta-binomial distribution by maximimum likelihood to account for variation in the binomial p
BinomOverdispersionTest	Pairwise tests of difference in fit of beta-binomial models for multiple groups
boxcox	Box-Cox transformation to symmetry
boxcoxb	Objective function for 'boxcox'
boxcoxinv	Inverse of Box-Cox transformation
boxcoxnorm	Modified Box-Cx transformation to normality
boxcoxnormf	Objective function for 'boxcoxnorm'
cauchyrnd	Random sample from a Cauchy distribution
centdist	Finds limits for a specified central portion of a distribution
cdfdata	Produces a cumulative distribution function from a data vector
cumstep	Converts discrete pdf into cumulative relative cdf for KS test
fdistnc	Cdf for noncentral F distribution
finvnc	Inverse cdf for noncentral F distribution
finvncob	Objective function for 'finvnc'
HistogramCIs	Confidence intervals on histogram bars
kurtosis	Unbiased estimate and standard error of kurtosis
gammalog	Log of the gamma function
meanwt	Weighted mean and variance
minkpdf	Pdf of a Minkowski distribution
minksamp	Random or systematic sample from a Minkowski distribution
moments	First r moments, by column

Multimodality	Dip test for multimodality in relation to uniform distribution
multnormpdf	Multivariate-normal probability density function
NormAreaFill	Draws normal distribution with filled tail or central area
nscores	Transforms data to normal scores
PearsonFitData	Fits continuous Pearson distribution function to a histogram
PearsonFitDataF	Objective function for 'histfit'
PearsonFitMoments	Fits Pearson distribution function to first four moments
poissci	Central confidence interval from Poisson distribution
poisfit	Fits Poisson distribution by minimizing a KS-statistic
poisfitf	Objective function for 'poisfit'
plotnorm	Draws normal distributions
rankits	Expected normal scores for an ordered random sample
unidsvar	Variance of uniform interval [p,q]

BOOTSTRAPPING AND RANDOMIZATION

bootbal	Randomized observation indices for a balanced bootstrap
bootci	Confidence limits from a bootstrap distribution
bootprob	Probability levels from bootstrap distributions
	Randomly samples rows of matrix, optionally within groups
Bootstrp	Generalized bootstrap function
iterations	Minimum number of iterations for a given confidence about a p-value
iterconf	Confidence interval about a p-value, given the number of iterations
randprob	Right-tailed probability from a randomized distribution

GENERATING RANDOM OBJECTS

AutocorrField	Random 1D, 2D or 3D field of autocorrelated values
BinaryAutocorr	Random autocorrelated binary strings
continrn	Random contingency table with fixed or floating totals
Initrand	Initializes rand() and randn() to clock seeds
mvngrps	Groups of MVN data for testing other procedures
prbcount	Random vector of counts from a vector of probabilities or proportions
randauto	Random vector of autocorrelated uniform random numbers
randautp	Predicts parameter c from autocorrelation coefficient
randbinm	Random binary matrix
randcirc	Random points within a circle
randcnvx	Random points within a specified convex polygon
randcorr	Random correlation/covariance matrix
randcova	Random points for an ANCOVA model, allowing unequal slopes
randint	Random integers
randmink	Random values from a Minkowski pdf with parameter k
randmvn	Random sample of multivariate-normal data
randnt	Random sample from truncated normal distribution
randpath	Random points along a specified line-segment path
randpermg	Randomly permuted matrix, optionally by groups
randpoly	Random points within a specified polygon
randprop	Random proportions
randstrb	Random sample from distrib with specified moment statistics
kurtopt	Objective function for 'randkurt'
kurttran	Power-transform of kurtosis of a distribution
momopt	Objective function for 'randstrb'
randkurt	Optimizes kurtosis
randskew	Optimizes skewness
randsplt	Plotting version of 'randstrb'
skewopt	Objective function for 'randskew'

skewtran	Power-transform of •istogra of a distribution
randsuit	Random data matrix for multiple groups of observations and suites of variables
randtree	Ancestor function for random tree based on Rohlf's M
walkdist	Random walk of taxa from common ancestor in 2 dimensions
walkrand	Random walk in p dimensions from origin of coordinate system

MANIPULATION OF MATRICES

AppendCols	Concatenates one matrix with another, padding columns if necessary
AppendRows	Concatenates one matrix with another, padding rows if necessary
bin2str	Converts binary matrix to character equivalent
CommonSize	Determines whether matrices have same size, or expand a scalar
CharRows2Scalar	Translates rows of character matrix to scalar numeric values, by row
FindCompleteData	Finds observations (or variables) having complete data
DealCols	Extracts columns of a matrix into separate column vectors
exchange	Exchanges two values
ExtractCols	Extracts columns of a matrix into separate column vectors
findsmatch	Finds values in common between two vectors
getobs	Extracts subset of observations based on group identifiers
isoutofbounds	Finds subscripts that are out of bounds
labtoval	Converts character-string label matrix to numeric vector
MinMaxMatrix	Finds values and positions of minima and maxima in 1-, 2-, or 3-dimensional matrix
minsize	Finds groups having at least a minimum sample size
misscheck	Checks for missing (non-finite) values in matrices
padcols	Pads narrower matrix with columns of NaN's (or other value)
padrows	Pads shorter matrix with rows of NaN's (or other value)
putdiag	Puts diagonal elements in a square matrix
randpermcols	Randomly permutes columns of a matrix
replace	Replacement of numeric values within a matrix
rescale	Centers and rescales data by pooled within-group stdev
reshapei	Maps subscripts from a matrix to a reshaped matrix (both 2D)
Rows2Values	Converts rows of integer or character matrix to vector of scalar values
samelength	Determines whether matices have same number of rows; expands scalars
SortCharMatrix	Sorts rows of character matrix into ascii collating sequence, allowing for case-insensitive sorting
sortmat	Sorts key vector, resequences other matrices to corresponding order
splitgrp	Splits data matrix into separate group matrices
str2int	Converts strings to integers
submatrows	Subsets of corresponding matrices by row
Subsamplegrps	Subsample a matrix by group
switchem	Switches contents of two matrices
TableLookup	Performs hash-table lookup in numeric or character table
trilow	Extracts lower triangular matrix (w/o diag) as column vector
trisqmat	Stashes triangular-matrix vectors + diagonal into square matrix
truncate	Truncates (fixes) a matrix to a specified number of decimal places
UniqueValues	List of unique group labels and corresponding frequencies
Values2Rows	Converts vector of numeric values to character matrix (see Rows2Values)
Vect2List	Converts vector to a string containing comma-delimited list

	of numeric values
wrap	Returns modified modulus for wrap-around arrays

BOUNDARIES & PATHS

AlignOutlines	Aligns two boundaries not necessarily described by corresponding sets of point coordinates
cubespln	Fits a cubic-splined boundary to a closed polygon
fourier	Fourier fitting of a quadratic-splined boundary
FourierEllipt	Fits elliptical Fourier function to closed boundary
FourierElliptRecon	Reconstructs boundary from elliptical Fourier coefficients
hausdorf	Hausdorff fractal dimension of a path
pathlen	Finds length of path connecting a set of points
pathmax	Finds longest path connecting a set of points
pathmin	Finds shortest path connecting a set of points (TSP)
pathnn	Finds the nearest-neighbor path(s) connecting a set of points
pathplot	Plots a path + nodes, with equal axes
pathpts	Evenly distributes points along a path
pathseg	Finds line-segment length to exactly step of a given number of steps
pathsegf	Finds residual distance after stepping off a given number of steps
pathsegr	Finds residual distance after stepping off line segment along path
pathstat	Calculates set of descriptors of a path
quadspln	Fits quadratic-splined (Oberhauser) boundary to an open/closed path
radiusfn	Finds and plots a radius function
randpath	Random points along a specified line-segment path
steplength	Step lengths along a path
tangentfn	Finds and plots a quadratically smoothed tangent-angle function

MANIPULATION OF POINT CONFIGURATIONS

angl	Angle made by three points
angledev	Signed angular deviations of points from reference ray
AngleRotation	Finds angle of rotation between two line segments with common vertex
areainpoly	Finds grid-cell areas lying within a polygon
areainpoly1	Finds area for grid cell with 1 vertex within or without polygon
areainpoly2	Finds area for grid cell with 2 vertices within polygon
asympoly	Minimum bilateral asymmetry (area, perimeter) of a polygon
refldiff	Finds difference between lateral boundaries
reflplot	Plots mirror images
reflstat	Finds lateral differences in area and perimeter
centroid	Robust estimate of centroid and median for 2D data
centsize	Centroid size of a point configuration
coeffdispersion	Finds coefficient of dispersion of points on grid
CrdsBilateralAvg	Averages bilateral asymmetry out of a set of landmark coordinates by reflection and Procrustes mapping
digitize	Gets point coordinates from image
distptsline	Distances from a set of points to a line
eucl	Euclidean distances among points
Gabriel	Gabriel connectivity graph among planar points
GeogDistance	Great-circle arc distance (km) between two geographic sites (lat/long)
geogkmns	Modification of the k-means procedure to cluster geographic localities

geomsize	Geometric-mean size of a point configuration
getaxes	Recovers axis tickmark positions from digitized scatterplot
getcoord	Recovers point coordinates from digitized scatterplot
getpolyg	Gets polygons from graphics window via mouse input
getptid	Determines point identifications from plot
getpts	Gets points from graphics window via mouse input
hull	Finds convex hull
HullIsopleths	Finds isopleths of 2D points from nested sets of convex hulls
hullpeel	Finds percentiles of 2D data from nested sets of convex hulls
Intrsect	Determines whether and where two line segments intersect
isinpoly	Determines whether a point lies within a polygon
IsLineSegsOverlap	Determines whether two line segments overlap; if so, returns their union
isonline	Determines whether a point lies on a line, within tolerance
LineConvert	Inter-converts line coordinates, points, angles
LineSegExtend	Extends a line (specified by two points) by a given distance
LineSegShift	Orthogonally shifts a line segment by a given distance
lstra	Orthogonal least-squares theta-rho (Procrustes) analysis
LstraGeneral	Generalized Procrustes superimposition of multiple forms
makepolygon	Forms polygon-vertex list from set of points
mds	Multidimensional scaling
mdsfunc	Objective function for multidimensional scaling
nearestline	Finds the nearest line segment for one or more points
nndist	Nearest neighbor distances
ntscrds	Converts point coordinates from NTS format (from TPSDIG) to [n x 2] matrix form
plotdist	Plots a set of landmarks and interpoint distances
polarcrd	Converts polar coordinates to rectangular, or vice versa
polyangl	Resamples polygon boundary by equal angular deviations
PolygonStats	Area, centroid, and perimeter of a closed polygon
polyaxes	Major and minor axes of a polygon
Polyolap	Area of overlap of two polygons
polystrn	Anisotropy and direction of a polygon
project	Projects points onto line
ptdir	Determines direction of path thru 3 points
randwalk	Generates and analyzes random walk in p dimensions
ReflectPts	Reflects a set of points about a line
RegisterRotate	Registers and rotates a point configuration
Rotate	Rotates point configuration about the centroid by a specified angle
runavg	Vectors smoothed by running average
SolidCircle	Plots a set of solid-circle symbols
spacecls	Randomized k means clustering for spatial distributions
theta	Returns value proportional to angular deviation of a point from horizontal
thinplate	Thin plate splines
triallom	Fits predicted triangles from regressions of sides on size
Triangulate	Finds the Delaunay triangulation among a set of landmarks
triangpt	Triangulates a point, given distances to two reference points
trusgrow	Grows a truss allometrically and plot the MDS stress function
unplot	Recovers data values from previously imaged scatterplot

MANIPULATION OF IMAGES

getavgcolor	Gets median color parameters within polygon
imagebox	Extracts rectangle within image

GRAPHICS

alloplot	Plots allometric coefficients as a horizontal bar chart
arrow	Draws arrow on current plot

arrowdwn	Downward arrow to mark positions on histograms
boxplot	Box plots
circcrds	Returns plotting coordinates for a specified circle
circdraw	Draws a circle of given radius
colrname	Returns name of color given RGB specification
conic	Generates plots of conics
corrcirc	Portrays correlation coefficient & CI in circular form
corrmap	Plots a color patch representation of correlation matrix
corrplot	Matrix of plots representing a correlation matrix
densplot	Scatterplot for two discrete variables
distfig	Plots figures of distances among landmarks, given coordinates and specimens
getchild	Lists handle & color of each child of current plot
getptid	Determines point identifications from plot
histgram	Histogram with continuous colored bars
histarw	Returns position of arrow and Adjustsed axis ranges
histbins	Puts data vector into bins for histogram
histpltb	Plots histogram bars
histgramb	Plots histogram, given midpoints and heights of bars
histplot	Matrix of histograms of columns (variables) of a data matrix
HistogramCIs	Confidence intervals on histogram bars
interpt	Plots landmarks and interpoint distances
lgspiral	Generates plots of logarithmic spirals
linelabl	Prints a label next to a line, based on line orientation
loadfig	Restores a figure from characteristics saved by savefig()
lollipop	3D lollipop scatter plot with points anchored by stem
NormAreaFill	Draws normal distribution with filled tail or central area
pcontour	Prepares MATLAB contour output for plotting with SIGMAPLOT
plotbern	Plots a Bernoulli distribution, for X={0,1}
plotbino	Plots binomial distribution, given N,p
plotgrps	Plot for several groups, with optional hulls, centroids, etc.
pltgrpch	Plots convex hulls
pltgrpcn	Plots group centroids
pltgrpma	Plots major axes and confidence ellipses
pltgrpmd	Plots group medians via hull peeling
pltgrpop	Sets option flags
pltgrppp	Plots points
pltgrppr	Plots regression lines
pltgrpse	Plots standard error bars
plotjoin	Connects pairs of points on scatterpoints
plotlabl	Plots corresponding labels rather than symbols
plotnorm	Draws normal distributions
PlotNormRot	Plots a rotated normal distribution
plotnum	Plots observation numbers rather than symbols
plotpt	Adds single point to existing plot, extending axes if necessary
plotrect	Plots rectangle, given opposing corners
plotsurface	Plots a mesh or surface plot
plotxyerror	Scatterplot of data +/ horizontal & vertical error bars
plotyerror	Scatterplot of data +/ vertical error bars
PlotUnique	Scatterplot for overlying points
plotvert	Plots vertical lines for multiple y's per x
ptscale	Scale point coordinates to proportions along current axes
putbnd	For 2D plot, changes scales of axes to 5% beyond range of data
putbnd3	For 3D plot, changes scales of axes to 5% beyond range of data
putlegnd	Puts a legend of character strings onto a plot
putregrline	adds regression line to current plot

puttext	Puts text on figure using proportional coords
puttitle	Puts title on figure with larger than default font
puttick	Changes the tick marks and labels of a plot
putxbnd	Changes min,max of x axis without changing y axis
putybnd	Changes min,max of y axis without changing x axis
putxlab	Puts xlabel on figure with larger than default font
putylab	Puts ylabel on figure with larger than default font
putzlab	Puts zlabel on figure with larger than default font
PutWhite	Changes figure background to white
savefig	Saves figure properties for later reconstruction
scatter	Simple unlabeled scatter plot of first two cols of a matrix
ScatterHist	Scatterplot with corresponding histograms for X and Y
sqplot	Returns axis bounds for a square plot with equal unit axes
vectplot	Produces vector plots of multivariate loadings (biplots)
vectplot1	One-dimensional vector plots
vectplot2	Two-dimensional vector plots
wordplot	Resets line widths for plots to be copied to Word documents

INPUT/OUTPUT

GetFilenames	Gets names of files within specified directory
Getkey	Waits for a single keystroke and returns ascii code
loadchar	Loads a character matrix from an ascii text file
loadfig	Restores a figure from characteristics saved by savefig()
LoadTxt	Load numeric/character data from an ascii text file
savefig	Saves figure properties for later reconstruction
tofile	Writes matrix to a specified file, in ascii

UTILITY

boottime	Elapsed time of a bootstrapped analysis
degday	Converts temperature measurements to accumulated degree-days
julian	Julian date (day of year, 1-365)
RenameFiles	Renames files within a given directory
testans	Generates random answers for a multiple-choice test

BEHAVIOR

BehaviorCode	Real-time event recorder for behavioral states
EthogramPlot	Plots an ethogram from a Markov transition matrix
MarkovOrder	Estimates the order of the Markov process from a behavioral sequence
MarkovScores	Estimates length-normalized log odds-ratio scores for a set of sequences
MarkovTest	Tests the null hypothesis that a single sequence of behavioral states is consistent with multinomial expectations
RandMarkovSeqs	Random Markov sequences from a matrix of transition probabilities
SequenceComplexity	Finds the *1*-subword complexity of one or more sequences of integers or character values
SequenceComplexityScores	Estimates sequence complexity scores for a set of sequences
SequenceToNum	Converts a character matrix of behavioral sequences to numeric
SequenceToTransition	Estimates Markov transition matrix from behavioral sequence
TimeBudgetDiffs	Distance matrix based on mean squared differences in equilibrium time budgets
TransitionEquilibriumFreqs	Finds equilibrium time budget from Markov transition matrix

ECOLOGY

coeffdispersion	Finds coefficient of dispersion of points on grid
diverdiff	Significance of difference in diversity between assemblages
diversity	Diversity and evenness indices
diversf	Objective function for diversity()
jaccard	Jaccard measure of association (=similarity)
jaccardd	Jaccard distance
percdist	Percent-similarity distance measure
rarefact	Rarefaction analysis of species assemblage
renkonen	Renkenon's percent-similarity distance measure

GENETICS

allelefreq	Allele frequencies and heterozygosity estimates
basediff	Proportional difference in base sequences between two taxa
basediffp	Creates pairwise contrasts from matrix of sequence data
distdiff	Tests for within- vs among-group pairwise distances or similarities
fstat	Wright's F-statistics, bootstrapped
fstatcum	Accumulation curves for F-statistics across populations
hetcum	Heterozygosity accumulation curves among popls
heterozyg	Heterozygosity estimates HI, HS, HT
hwexact	Exact Hardy-Weinberg probabilities (1 locus, 2 alleles)
hwmult	Asymptotic or permutation G-test for multiple alleles
hwmultll	Log-likelihood G-statistic for multiple-allele test
micsatfs	Measures of population subdivision based on microsatellite loci
micsatvs	Variance statistics I,S,T
micsatgd	Genetic distances based on microsatellite loci
micsatfr	Allele frequencies from data on individuals
micsatds	Genetic distance matrix
mindetect	Minimum sample size needed to detect a given allele frequency
mindetectf	Randomization function for mindetect()
rarefact	rarefaction analysis of numbers of alleles
repeats	Tests statistical significance of tandem repeats