

R for MATLAB users

Help

R/S-Plus	MATLAB/Octave	Description
<code>help.start()</code>	<code>doc</code> <code>help -i % browse with Info</code>	Browse help interactively
<code>help()</code>	<code>help help or doc doc</code>	Help on using help
<code>help(plot) or ?plot</code>	<code>help plot</code>	Help for a function
<code>help(package='splines')</code>	<code>help splines or doc splines</code>	Help for a toolbox/library package
<code>demo()</code>	<code>demo</code>	Demonstration examples
<code>example(plot)</code>		Example using a function

Searching available documentation

R/S-Plus	MATLAB/Octave	Description
<code>help.search('plot')</code>	<code>lookfor plot</code>	Search help files
<code>apropos('plot')</code>		Find objects by partial name
<code>library()</code>	<code>help</code>	List available packages
<code>find(plot)</code>	<code>which plot</code>	Locate functions
<code>methods(plot)</code>		List available methods for a function

Using interactively

R/S-Plus	MATLAB/Octave	Description
<code>Rgui</code>	<code>octave -q</code>	Start session
<code>source('foo.R')</code>	<code>foo(.m)</code>	Run code from file
<code>history()</code>	<code>history</code>	Command history
<code>savehistory(file=".Rhistory")</code>	<code>diary on [..] diary off</code>	Save command history
<code>q(save='no')</code>	<code>exit or quit</code>	End session

Operators

R/S-Plus	MATLAB/Octave	Description
<code>help(Syntax)</code>	<code>help -</code>	Help on operator syntax

Arithmetic operators

R/S-Plus	MATLAB/Octave	Description
<code>a<-1; b<-2</code>	<code>a=1; b=2;</code>	Assignment; defining a number

`a + b`
`a - b`
`a * b`
`a / b`
`a ^ b`
`a %% b`
`a %/% b`
`factorial(a)`

`a + b`
`a - b`
`a * b`
`a / b`
`a .^ b`
`rem(a,b)`

`factorial(a)`

Addition
 Subtraction
 Multiplication
 Division
 Power, a^b
 Remainder
 Integer division
 Factorial, $n!$

Relational operators

R/S-Plus

`a == b`
`a < b`
`a > b`
`a <= b`
`a >= b`
`a != b`

MATLAB/Octave

`a == b`
`a < b`
`a > b`
`a <= b`
`a >= b`
`a ~= b`

Description

Equal
 Less than
 Greater than
 Less than or equal
 Greater than or equal
 Not Equal

Logical operators

R/S-Plus

`a && b`
`a || b`
`a & b`
`a | b`
`xor(a, b)`
`!a`

MATLAB/Octave

`a && b`
`a || b`
`a & b` *or* `and(a,b)`
`a | b` *or* `or(a,b)`
`xor(a, b)`
`~a` *or* `not(a)`
`~a` *or* `!a`
`any(a)`
`all(a)`

Description

Short-circuit logical AND
 Short-circuit logical OR
 Element-wise logical AND
 Element-wise logical OR
 Logical EXCLUSIVE OR
 Logical NOT

 True if any element is nonzero
 True if all elements are nonzero

root and logarithm

R/S-Plus

`sqrt(a)`
`log(a)`
`log10(a)`
`log2(a)`
`exp(a)`

MATLAB/Octave

`sqrt(a)`
`log(a)`
`log10(a)`
`log2(a)`
`exp(a)`

Description

Square root
 Logarithm, base e (natural)
 Logarithm, base 10
 Logarithm, base 2 (binary)
 Exponential function

Round off

R/S-Plus

round(a)
ceil(a)
floor(a)

MATLAB/Octave

round(a)
ceil(a)
floor(a)
fix(a)

Description

Round
Round up
Round down
Round towards zero

Mathematical constants**R/S-Plus**

pi
exp(1)

MATLAB/Octave

pi
exp(1)

Description

$\pi=3.141592$
 $e=2.718281$

Missing values; IEEE-754 floating point status flags**R/S-Plus****MATLAB/Octave**

NaN
Inf

Description

Not a Number
Infinity, ∞

Complex numbers**R/S-Plus**

i
z <- 3+4i
abs(3+4i) *or* Mod(3+4i)
Re(3+4i)
Im(3+4i)
Arg(3+4i)
Conj(3+4i)

MATLAB/Octave

i
z = 3+4i
abs(z)
real(z)
imag(z)
arg(z)
conj(z)

Description

Imaginary unit
A complex number, $3+4i$
Absolute value (modulus)
Real part
Imaginary part
Argument
Complex conjugate

Trigonometry**R/S-Plus**

atan2(b,a)

MATLAB/Octave

atan(a,b)

Description

Arctangent, $\arctan(b/a)$

Generate random numbers**R/S-Plus**

runif(10)
runif(10, min=2, max=7)

MATLAB/Octave

rand(1,10)
2+5*rand(1,10)

Description

Uniform distribution
Uniform: Numbers between 2 and 7
Uniform: 6,6 array
Normal distribution

matrix(runif(36),6)
rnorm(10)

rand(6)
randn(1,10)

Vectors

R/S-Plus

```
a <- c(2,3,4,5)
adash <- t(c(2,3,4,5))
```

MATLAB/Octave

```
a=[2 3 4 5];
adash=[2 3 4 5]';
```

Description

Row vector, $1 \times n$ -matrix
Column vector, $m \times 1$ -matrix

Sequences

R/S-Plus

```
seq(10) or 1:10
seq(0, length=10)
seq(1, 10, by=3)
seq(10, 1) or 10:1
seq(from=10, to=1, by=-3)
seq(1, 10, length=7)

rev(a)
```

MATLAB/Octave

```
1:10
0:9
1:3:10
10:-1:1
10:-3:1
linspace(1, 10, 7)

reverse(a)
a(:) = 3
```

Description

1,2,3, ... ,10
0.0,1.0,2.0, ... ,9.0
1,4,7,10
10,9,8, ... ,1
10,7,4,1
Linearly spaced vector of $n=7$ points
Reverse
Set all values to same scalar value

Concatenation (vectors)

R/S-Plus

```
c(a, a)
c(1:4, a)
```

MATLAB/Octave

```
[a a]
[1:4 a]
```

Description

Concatenate two vectors

Repeating

R/S-Plus

```
rep(a, times=2)
rep(a, each=3)
rep(a, a)
```

MATLAB/Octave

```
[a a]
```

Description

1 2 3, 1 2 3
1 1 1, 2 2 2, 3 3 3
1, 2 2, 3 3 3

Miss those elements out

R/S-Plus

```
a[-1]
a[-10]
a[-seq(1, 50, 3)]
```

MATLAB/Octave

```
a(2:end)
a([1:9])

a(end)
a(end-1:end)
```

Description

miss the first element
miss the tenth element
miss 1,4,7, ...
last element
last two elements

Maximum and minimum

R/S-Plus

```
pmax(a, b)
```

MATLAB/Octave

```
max(a, b)
```

Description

pairwise max

```
max(a,b)
v <- max(a) ; i <- which.max(a) [v,i] = max(a)
```

max of all values in two vectors

Vector multiplication

R/S-Plus

```
a*a
```

MATLAB/Octave

```
a.*a
dot(u,v)
```

Description

Multiply two vectors

Vector dot product, $u \cdot v$

Matrices

R/S-Plus

```
rbind(c(2,3),c(4,5))
array(c(2,3,4,5), dim=c(2,2))
```

MATLAB/Octave

```
a = [2 3;4 5]
```

Description

Define a matrix

Concatenation (matrices); rbind and cbind

R/S-Plus

```
rbind(a,b)
cbind(a,b)
```

MATLAB/Octave

```
[a ; b]
[a , b]
[a(:), b(:)]
```

Description

Bind rows

Bind columns

Concatenate matrices into one vector

```
rbind(1:4,1:4)
```

```
[1:4 ; 1:4]
```

Bind rows (from vectors)

```
cbind(1:4,1:4)
```

```
[1:4 ; 1:4]'
```

Bind columns (from vectors)

Array creation

R/S-Plus

```
matrix(0,3,5) or array(0,c(3,5))
matrix(1,3,5) or array(1,c(3,5))
matrix(9,3,5) or array(9,c(3,5))
diag(1,3)
diag(c(4,5,6))
```

MATLAB/Octave

```
zeros(3,5)
ones(3,5)
ones(3,5)*9
eye(3)
diag([4 5 6])
magic(3)
```

Description

0 filled array

1 filled array

Any number filled array

Identity matrix

Diagonal

Magic squares; Lo Shu

Reshape and flatten matrices

R/S-Plus

```
matrix(1:6,nrow=3,byrow=T)
matrix(1:6,nrow=2)
array(1:6,c(2,3))
as.vector(t(a))
as.vector(a)
```

MATLAB/Octave

```
reshape(1:6,3,2)';
reshape(1:6,2,3);
a'(:)
a(:)
```

Description

Reshaping (rows first)

Reshaping (columns first)

Flatten to vector (by rows, like comics)

Flatten to vector (by columns)

```
a[row(a) <= col(a)]
```

```
vech(a)
```

Flatten upper triangle (by columns)

Shared data (slicing)

R/S-Plus

```
b = a
```

MATLAB/Octave

```
b = a
```

Description

Copy of a

Indexing and accessing elements (Python: slicing)

R/S-Plus

```
a <- rbind(c(11, 12, 13, 14),
c(21, 22, 23, 24),
c(31, 32, 33, 34))
```

```
a[2,3]
```

```
a[1,]
```

```
a[,1]
```

```
a[-1,]
```

```
a[-2,-3]
```

```
a[, -2]
```

MATLAB/Octave

```
a = [ 11 12 13 14 ...
21 22 23 24 ...
31 32 33 34 ]
```

```
a(2,3)
```

```
a(1,:)
```

```
a(:,1)
```

```
a([1 3],[1 4]);
```

```
a(2:end,:)
```

```
a(end-1:end,:)
```

```
a(1:2:end,:)
```

```
a(:, [1 3 4])
```

Description

Input is a 3,4 array

Element 2,3 (row,col)

First row

First column

Array as indices

All, except first row

Last two rows

Strides: Every other row

All, except row,column (2,3)

Remove one column

Assignment

R/S-Plus

```
a[,1] <- 99
```

```
a[,1] <- c(99,98,97)
```

```
a[a>90] <- 90
```

MATLAB/Octave

```
a(:,1) = 99
```

```
a(:,1) = [99 98 97]'
```

```
a(a>90) = 90;
```

Description

Clipping: Replace all elements over 90

Transpose and inverse

R/S-Plus

```
t(a)
```

```
det(a)
```

```
solve(a)
```

```
ginv(a)
```

```
eigen(a)$values
```

```
svd(a)$d
```

MATLAB/Octave

```
a'
```

```
a.' or transpose(a)
```

```
det(a)
```

```
inv(a)
```

```
pinv(a)
```

```
norm(a)
```

```
eig(a)
```

```
svd(a)
```

```
chol(a)
```

Description

Transpose

Non-conjugate transpose

Determinant

Inverse

Pseudo-inverse

Norms

Eigenvalues

Singular values

Cholesky factorization

```
eigen(a)$vectors
rank(a)
```

```
[v,l] = eig(a)
rank(a)
```

Eigenvectors
Rank

Sum

R/S-Plus

```
apply(a,2,sum)
apply(a,1,sum)
sum(a)
apply(a,2,cumsum)
```

MATLAB/Octave

```
sum(a)
sum(a')
sum(sum(a))
cumsum(a)
```

Description

Sum of each column
Sum of each row
Sum of all elements
Cumulative sum (columns)

Sorting

R/S-Plus

```
t(sort(a))
apply(a,2,sort)
t(apply(a,1,sort))

order(a)
```

MATLAB/Octave

```
a = [ 4 3 2 ; 2 8 6 ; 1 4 7 ]
sort(a(:))
sort(a)
sort(a')'
sortrows(a,1)
```

Description

Example data
Flat and sorted
Sort each column
Sort each row
Sort rows (by first row)
Sort, return indices

Maximum and minimum

R/S-Plus

```
apply(a,2,max)
apply(a,1,max)
max(a)
i <- apply(a,1,which.max)
pmax(b,c)
apply(a,2,cummax)
```

MATLAB/Octave

```
max(a)
max(a')
max(max(a))
[v i] = max(a)
max(b,c)
cummax(a)
```

Description

max in each column
max in each row
max in array
return indices, i
pairwise max

Matrix manipulation

R/S-Plus

```
a[,4:1]
a[3:1,]

kronecker(matrix(1,2,3),a)

a[lower.tri(a)] <- 0
a[upper.tri(a)] <- 0
```

MATLAB/Octave

```
fliplr(a)
flipud(a)
rot90(a)
repmat(a,2,3)
kron(ones(2,3),a)
triu(a)
tril(a)
```

Description

Flip left-right
Flip up-down
Rotate 90 degrees
Repeat matrix: [a a a ; a a a]

Triangular, upper
Triangular, lower

Equivalents to "size"

R/S-Plus	MATLAB/Octave	Description
<code>dim(a)</code>	<code>size(a)</code>	Matrix dimensions
<code>ncol(a)</code>	<code>size(a,2)</code> <i>or</i> <code>length(a)</code>	Number of columns
<code>prod(dim(a))</code>	<code>length(a(:))</code>	Number of elements
	<code>ndims(a)</code>	Number of dimensions
<code>object.size(a)</code>		Number of bytes used in memory

Matrix- and elementwise- multiplication

R/S-Plus	MATLAB/Octave	Description
<code>a * b</code>	<code>a .* b</code>	Elementwise operations
<code>a %% b</code>	<code>a * b</code>	Matrix product (dot product)
<code>outer(a,b)</code> <i>or</i> <code>a %o% b</code>		Outer product
<code>crossprod(a,b)</code> <i>or</i> <code>t(a) %% b</code>		Cross product
<code>kronecker(a,b)</code>	<code>kron(a,b)</code>	Kronecker product
	<code>a / b</code>	Matrix division, $\{\cdot\}a^{-1}$
<code>solve(a,b)</code>	<code>a \ b</code>	Left matrix division, $a\{\cdot\}$ (solve linear equations)

Find; conditional indexing

R/S-Plus	MATLAB/Octave	Description
<code>which(a != 0)</code>	<code>find(a)</code>	Non-zero elements, indices
<code>which(a != 0, arr.ind=T)</code>	<code>[i j] = find(a)</code>	Non-zero elements, array indices
<code>ij <- which(a != 0, arr.ind=T);</code> <code>v <- a[ij]</code>	<code>[i j v] = find(a)</code>	Vector of non-zero values
<code>which(a>5.5)</code>	<code>find(a>5.5)</code>	Condition, indices
<code>ij <- which(a>5.5, arr.ind=T); v</code> <code><- a[ij]</code>		Return values
	<code>a .* (a>5.5)</code>	Zero out elements above 5.5

Multi-way arrays

R/S-Plus	MATLAB/Octave	Description
	<code>a = cat(3, [1 2; 1 2], [3 4; 3 4]);</code> <code>a(1, :, :)</code>	Define a 3-way array

File input and output

R/S-Plus	MATLAB/Octave	Description
<code>f <- read.table("data.txt")</code>	<code>f = load('data.txt')</code>	Reading from a file (2d)
<code>f <- read.table("data.txt")</code>	<code>f = load('data.txt')</code>	Reading from a file (2d)


```
f <- read.table(file="data.csv", x = dlmread('data.csv', ';')
sep=";")
write(f,file="data.txt")
```

Reading from a CSV file (2d)

```
save -ascii data.txt f
```

Writing to a file (2d)

Plotting

Basic x-y plots

R/S-Plus

```
plot(a, type="l")
plot(x[,1],x[,2])

plot(x1,y1)
matplot(x2,y2,add=T)

plot(x,y,type="b",col="red")
```

MATLAB/Octave

```
plot(a)
plot(x(:,1),x(:,2),'o')
plot(x1,y1, x2,y2)
plot(x1,y1)
hold on
plot(x2,y2)
subplot(211)
plot(x,y, 'ro-')
```

Description

1d line plot
 2d scatter plot
 Two graphs in one plot
 Overplotting: Add new plots to current

 subplots
 Plotting symbols and color

Axes and titles

R/S-Plus

```
grid()
plot(c(1:10,10:1), asp=1)

plot(x,y, xlim=c(0,10),
ylim=c(0,5))
plot(1:10, main="title",
xlab="x-axis", ylab="y-axis")
```

MATLAB/Octave

```
grid on
axis equal
axis('equal')
replot

axis([ 0 10 0 5 ])

title('title')
xlabel('x-axis')
ylabel('y-axis')
```

Description

Turn on grid lines
 1:1 aspect ratio

 Set axes manually

 Axis labels and titles

Log plots

R/S-Plus

```
plot(x,y, log="y")
plot(x,y, log="x")
plot(x,y, log="xy")
```

MATLAB/Octave

```
semilogy(a)
semilogx(a)
loglog(a)
```

Description

logarithmic y-axis
 logarithmic x-axis
 logarithmic x and y axes

Filled plots and bar plots

R/S-Plus

```
plot(t,s, type="n", xlab="",
ylab="")
polygon(t,s, col="lightblue")
polygon(t,c, col="lightgreen")
```

MATLAB/Octave

```
fill(t,s,'b', t,c,'g')
% fill has a bug?
```

Description

Filled plot

```
stem(x[,3])
```

Stem-and-Leaf plot

Functions

R/S-Plus

```
f <- function(x) sin(x/3) -  
cos(x/5)
```

```
plot(f, xlim=c(0,40), type='p')
```

MATLAB/Octave

```
f = inline('sin(x/3) - cos(x/5)')
```

```
ezplot(f,[0,40])
```

```
fplot('sin(x/3) - cos(x/5)',  
[0,40])
```

```
% no ezplot
```

Description

Defining functions

Plot a function for given range

Polar plots

R/S-Plus

MATLAB/Octave

```
theta = 0:.001:2*pi;
```

```
r = sin(2*theta);
```

```
polar(theta, rho)
```

Description

Histogram plots

R/S-Plus

```
hist(rnorm(1000))
```

```
hist(rnorm(1000), breaks= -4:4)
```

```
hist(rnorm(1000),  
breaks=c(seq(-5,0,0.25),  
seq(0.5,5,0.5)), freq=F)
```

```
plot(apply(a,1,sort),type="l")
```

MATLAB/Octave

```
hist(randn(1000,1))
```

```
hist(randn(1000,1), -4:4)
```

```
plot(sort(a))
```

Description

3d data

Contour and image plots

R/S-Plus

```
contour(z)
```

```
filled.contour(x,y,z,  
nlevels=7, color=gray.colors)
```

```
image(z, col=gray.colors(256))
```

MATLAB/Octave

```
contour(z)
```

```
contourf(z); colormap(gray)
```

```
image(z)
```

```
colormap(gray)
```

```
quiver()
```

Description

Contour plot

Filled contour plot

Plot image data

Direction field vectors

Perspective plots of surfaces over the x-y plane

R/S-Plus

```
f <- function(x,y) x*exp(-x^2-
```

MATLAB/Octave

```
n=-2:.1:2;
```

Description

```

y^2)
n <- seq(-2,2, length=40)
z <- outer(n,n,f)

persp(x,y,z,
theta=30, phi=30, expand=0.6,
ticktype='detailed')

persp(x,y,z,
theta=30, phi=30, expand=0.6,
col='lightblue', shade=0.75,
ltheta=120,
ticktype='detailed')

```

```

[x,y] = meshgrid(n,n);
z=x.*exp(-x.^2-y.^2);

mesh(z)

```

Mesh plot

```

surf(x,y,z) or surf1(x,y,z)
% no surf1()

```

Surface plot

Scatter (cloud) plots

R/S-Plus

```
cloud(z~x*y)
```

MATLAB/Octave

```
plot3(x,y,z, 'k+')
```

Description

3d scatter plot

Save plot to a graphics file

R/S-Plus

```

postscript(file="foo.eps")
plot(1:10)
dev.off()

```

MATLAB/Octave

```

plot(1:10)
print -depsc2 foo.eps
gset output "foo.eps"
gset terminal postscript eps
plot(1:10)

```

Description

PostScript

```
pdf(file='foo.pdf')
```

```
devSVG(file='foo.svg')
```

```
png(filename = "Rplot%03d.png")
```

```
print -dpng foo.png
```

PDF

SVG (vector graphics for www)

PNG (raster graphics)

Data analysis

Set membership operators

R/S-Plus

```

a <- c(1,2,2,5,2)
b <- c(2,3,4)

unique(a)
union(a,b)
intersect(a,b)
setdiff(a,b)
setdiff(union(a,b),intersect(a,b))
is.element(2,a) or 2 %in% a

```

MATLAB/Octave

```

a = [ 1 2 2 5 2 ];
b = [ 2 3 4 ];

unique(a)
union(a,b)
intersect(a,b)
setdiff(a,b)
setxor(a,b)
ismember(2,a)

```

Description

Create sets

Set unique

Set union

Set intersection

Set difference

Set exclusion

True for set member

Statistics

R/S-Plus

MATLAB/Octave

Description

<code>apply(a,2,mean)</code>	<code>mean(a)</code>	Average
<code>apply(a,2,median)</code>	<code>median(a)</code>	Median
<code>apply(a,2,sd)</code>	<code>std(a)</code>	Standard deviation
<code>apply(a,2,var)</code>	<code>var(a)</code>	Variance
<code>cor(x,y)</code>	<code>corr(x,y)</code>	Correlation coefficient
<code>cov(x,y)</code>	<code>cov(x,y)</code>	Covariance

Interpolation and regression

R/S-Plus	MATLAB/Octave	Description
<code>z <- lm(y~x)</code> <code>plot(x,y)</code> <code>abline(z)</code> <code>solve(a,b)</code>	<code>z = polyval(polyfit(x,y,1),x)</code> <code>plot(x,y,'o', x,z , '-')</code> <code>a = x\y</code> <code>polyfit(x,y,3)</code>	Straight line fit Linear least squares $y = ax + b$ Polynomial fit

Non-linear methods

Polynomials, root finding

R/S-Plus	MATLAB/Octave	Description
<code>polyroot(c(1,-1,-1))</code>	<code>roots([1 -1 -1])</code> <code>f = inline('1/x - (x-1)')</code> <code>fzero(f,1)</code> <code>solve('1/x = x-1')</code> <code>polyval([1 2 1 2],1:10)</code>	Find zeros of polynomial Find a zero near $x = 1$ Solve symbolic equations Evaluate polynomial

Differential equations

R/S-Plus	MATLAB/Octave	Description
	<code>diff(a)</code>	Discrete difference function and approximate derivative Solve differential equations

Fourier analysis

R/S-Plus	MATLAB/Octave	Description
<code>fft(a)</code> <code>fft(a, inverse=TRUE)</code>	<code>fft(a)</code> <code>ifft(a)</code>	Fast fourier transform Inverse fourier transform

Symbolic algebra; calculus

R/S-Plus	MATLAB/Octave	Description
	<code>factor()</code>	Factorization

Programming

R/S-Plus	MATLAB/Octave	Description
.R	.m	Script file extension
#	% <i>% or #</i>	Comment symbol (rest of line)
library(RSvgDevice)	% must be in MATLABPATH <i>% must be in LOADPATH</i>	Import library functions
string <- "a <- 234" eval(parse(text=string))	string='a=234'; eval(string)	Eval

Loops

R/S-Plus	MATLAB/Octave	Description
for(i in 1:5) print(i)	for i=1:5; disp(i); end	for-statement
for(i in 1:5) { print(i) print(i*2) }	for i=1:5 disp(i) disp(i*2) end	Multiline for statements

Conditionals

R/S-Plus	MATLAB/Octave	Description
if (1>0) a <- 100	if 1>0 a=100; end	if-statement
ifelse(a>0,a,0)	if 1>0 a=100; else a=0; end	if-else-statement
		Ternary operator (if?true:false)

Debugging

R/S-Plus	MATLAB/Octave	Description
.Last.value	ans	Most recent evaluated expression
objects()	whos <i>or</i> who	List variables loaded into memory
rm(x)	clear x <i>or</i> clear [all]	Clear variable \$x\$ from memory
print(a)	disp(a)	Print

Working directory and OS

R/S-Plus	MATLAB/Octave	Description
list.files() <i>or</i> dir()	dir <i>or</i> ls	List files in directory
list.files(pattern=".r\$")	what	List script files in directory
getwd()	pwd	Displays the current working directory
setwd('foo')	cd foo	Change working directory
system("notepad")	!notepad <i>system("notepad")</i>	Invoke a System Command

Time-stamp: "2007-11-09T16:46:36 vidar"

©2006 Vidar Bronken Gundersen, /mathesaurus.sf.net

Permission is granted to copy, distribute and/or modify this document as long as the above attribution is retained.