

# R for MATLAB [AND IGOR] users

## IGOR Specifics

IGOR	Description
a[0]	first point, index from 0, not 1
a[0], a(0)	[point scaling], (x scaling)
setscale/P x,0,0.1,"sec",a	sets x scaling to 10 Hz, display a will display it with this scaling correct on the x-axis
aa[0] == AA[0] == aA[0] == Aa[0]	Caps don't matter
\$	turn string into a name
function stringIntoWave(str)	
string str	
WAVE w = \$str	Example of \$ and WAVE assignment in function
display w	
end	
Wavestats/R=() or [] /Q (in function)	Really useful, /R for range, /Q for quiet; return V_numpts, V_avg, V_sdev, V_max, V_maxloc, V_min, V_minlo, etc. all variables that can be immediately used
b[0,10][[]] = a[p][q][r]	references in assignments to rows (p), columns (q), planes (r)
make a = p	makes 128 wave a = {0,1,2,3...}
variable var = 10	makes variable var = 10
string str = "Igor Pro"	makes string str = "Igor Pro"
WAVE w NVAR var SVAR str	Local references to global waves (waves are automatically global), global variables, and global strings

## Help

R/S-Plus	MATLAB/Octave	IGOR	Description
help.start()	doc help -i % browse with Info	Help: Igor Help Browser	Browse help interactively
help()	help help Or doc doc		Help on using help

<code>help(plot)</code> or <code>?plot</code>	<code>help plot</code>	right click function name 'Help for function'	Help for a function
<code>help(package='splines')</code>	<code>help splines</code> or <code>doc splines</code>		Help for a toolbox/library package
<code>demo()</code>	<code>demo</code>	File: Example Experiments	Demonstration examples
<code>example(plot)</code>			Example using a function

## Searching available documentation

R/S-Plus	MATLAB/Octave	IGOR	Description
<code>help.search('plot')</code>	<code>lookfor plot</code>	Help Browser: Search Igor Files	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>		'Help for function'	List available methods for a function

## Using interactively

R/S-Plus	MATLAB/Octave	IGOR	Description
<code>Rgui</code>	<code>octave -q</code>	Start IGOR	Start session
<code>source('foo.R')</code>	<code>foo(.m)</code>	'Function_name'()	Run code from file
<code>history()</code>	<code>history</code>	Printed	Command history
<code>savehistory(file=".Rhistory")</code>	<code>diary on [..] diary off</code>	Select, paste	Save command history
<code>q(save='no')</code>	<code>exit</code> or <code>quit</code>	<code>quit()</code>	End session
		<code>print a + b</code>	for results to be printed to history

## Operators

R/S-Plus	MATLAB/Octave	IGOR	Description
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help(Syntax)      help -

Command Help:  
Programming: Operators

Help on operator  
syntax

Matrices, see help for  
'MatrixOP'

## Arithmetic operators

R/S-Plus	MATLAB/Octave	IGOR	Description
a<-1; b<-2	a=1; b=2;	variable a = 1, b =2	Assignment; defining a number
a + b	a + b	a + b	Addition
a - b	a - b	a - b	Subtraction
a * b	a * b	a * b	Multiplication
a / b	a / b	a / b	Division
a ^ b	a .^ b	a ^ b	Power, \$a^b\$
a %% b	rem(a,b)	mod(a,b)	Remainder
a %/% b			Integer division
factorial(a)	factorial(a)	factorial(a)	Factorial, \$n!\$

## Relational operators

R/S-Plus	MATLAB/Octave	IGOR	Description
a == b	a == b	a == b	Equal
a < b	a < b	a < b	Less than
a > b	a > b	a > b	Greater than
a <= b	a <= b	a <= b	Less than or equal
a >= b	a >= b	a >= b	Greater than or equal
a != b	a ~= b	a != b	Not Equal

## Logical operators

R/S-Plus	MATLAB/Octave	IGOR	Description
a && b	a && b	a && b	Short-circuit logical AND
a    b	a    b	a    b	Short-circuit logical OR
a & b	a & b Or and(a,b)	a & b	Element-wise logical AND
a   b	a   b Or or(a,b)	a   b	Element-wise logical OR
xor(a, b)	xor(a, b)	a %^ b	Logical

!a	~a Or not(a) ~a or !a	!a	EXCLUSIVE OR Logical NOT
	any(a)		True if any element is nonzero
	all(a)		True if all elements are nonzero

## root and logarithm

R/S-Plus	MATLAB/Octave	IGOR	Description
sqrt(a)	sqrt(a)	sqrt(a)	Square root
log(a)	log(a)	ln(a)	Logarithm, base e (natural)
log10(a)	log10(a)	log(a)	Logarithm, base 10
log2(a)	log2(a)	log2(a)	Logarithm, base 2 (binary)
exp(a)	exp(a)	exp(a)	Exponential function

## Round off

R/S-Plus	MATLAB/Octave	IGOR	Description
round(a)	round(a)	round(a)	Round
ceil(a)	ceil(a)	ceil(a)	Round up
floor(a)	floor(a)	floor(a)	Round down
	fix(a)	trunc(a)	Round towards zero

## Mathematical constants

R/S-Plus	MATLAB/Octave	IGOR	Description
pi	pi	pi	$\pi=3.141592$
exp(1)	exp(1)	e	$e=2.718281$

## Missing values; IEEE-754 floating point status flags

R/S-Plus	MATLAB/Octave	IGOR	Description
	NaN	NaN	Not a Number
	Inf	inf	Infinity, $\infty$

## Complex numbers

R/S-Plus	MATLAB/Octave	IGOR	Description
<code>1i</code>	<code>i</code>	<code>i</code>	Imaginary unit
<code>z &lt;- 3+4i</code>	<code>z = 3+4i</code>	variable/c <code>z = cmplx(3,4)</code>	A complex number, $3+4i$
<code>abs(3+4i)</code> Or <code>Mod(3+4i)</code>	<code>abs(z)</code>	<code>sqrt(magsqr(z))</code>	Absolute value (modulus)
<code>Re(3+4i)</code>	<code>real(z)</code>	<code>real(z)</code>	Real part
<code>Im(3+4i)</code>	<code>imag(z)</code>	<code>imag(z)</code>	Imaginary part
<code>Arg(3+4i)</code>	<code>arg(z)???</code>		Argument
<code>Conj(3+4i)</code>	<code>conj(z)</code>	<code>conj(z)</code>	Complex conjugate

## Trigonometry - \*\*IF IGOR IS SAME AS MATLAB, NOT ENTERING FROM HERE FORWARD

R/S-Plus	MATLAB/Octave	Description
<code>atan2(b,a)</code>	<code>atan(a,b)</code>	Arctangent, $\arctan(b/a)$

## Generate random numbers

R/S-Plus	MATLAB/Octave	IGOR	Description
<code>runif(10)</code>	<code>rand(1,10)</code>	<code>enoise(r)</code>	Uniform distribution [of $\pm$ range r IGOR]
<code>runif(10, min=2, max=7)</code>	<code>2+5*rand(1,10)</code>	<code>2+abs(enoise(5))</code>	Uniform: Numbers between 2 and 7
<code>matrix(runif(36),6)</code>	<code>rand(6)</code>	make/N=(6,6) <code>A = enoise(1)</code>	Uniform: 6,6 array
<code>rnorm(10)</code>	<code>randn(1,10)</code>	<code>gnoise(Sdev)</code>	Normal distribution [of standard deviation Sdev]

## Vectors

R/S-Plus	MATLAB/Octave	IGOR	Description
<code>a &lt;- c(2,3,4,5)</code>	<code>a=[2 3 4 5];</code>	make/N=4 <code>a = {2, 3, 4, 5}</code>	Row vector, $1 \times n$ -matrix
<code>adash &lt;- t(c(2,3,4,5))</code>	<code>adash=[2 3 4 5]';</code>	prev then <code>matrixtranspose(a)</code> or make/N=(1,4) <code>a</code>	Column vector, $m \times 1$ -matrix

## Sequences

R/S-Plus	MATLAB/Octave	IGOR	Description
seq(10) or 1:10	1:10	make/N=10 a = p+1	1,2,3, ... ,10
seq(0,length=10)	0:9	make/N=10 a = p	0.0,1.0,2.0, ... ,9.0
seq(1,10,by=3)	1:3:10	make/N=4 a = p*3+1	1,4,7,10
seq(10,1) or 10:1	10:-1:1	make/N=10 a = 10-p	10,9,8, ... ,1
seq(from=10,to=1,by=-3)	10:-3:1	make/N=4 a = 10-(p*3)	10,7,4,1
seq(1,10,length=7)	linspace(1,10,7)		Linearly spaced vector of n=7 points
rev(a)	reverse(a)	sort/R a,a	Reverse
	a(:) = 3	a = 3 or a[] = 3	Set all values to same scalar value

## Concatenation (vectors)

R/S-Plus	MATLAB/Octave	Description
c(a,a) [a a]		Concatenate two vectors
c(1:4,a) [1:4 a]		

## Repeating

R/S-Plus	MATLAB/Octave	IGOR	Description
rep(a,times=2)	[a a]	see concatenate	1 2 3, 1 2 3
rep(a,each=3)			1 1 1, 2 2 2, 3 3 3
rep(a,a)			1, 2 2, 3 3 3

## Miss those elements out

R/S-Plus	MATLAB/Octave	IGOR	Description
a[-1]	a(2:end)	a[1,] doesn't work with print, only assignment	miss the first element
a[-10]	a([1:9])	a[,numpts(a)-2]	miss the tenth element
a[-seq(1,50,3)]		a[0,;3]	miss 1,4,7, ...
	a(end)	a[numpts(a)] or a[numpts(a)-1] SAME	last element
	a(end-1:end)	a[numpts(a)-2,]	last two elements

## Maximum and minimum

R/S-Plus	MATLAB/Octave	IGOR	Description
pmax(a,b)	max(a,b)	max(a,b)	pairwise max

<code>max(a,b)</code>	<code>max([a b])</code>	<code>max(wavemax(a),wavemax(b))</code>	max of all values in two vectors
<code>v &lt;- max(a) ; i &lt;- which.max(a) [v,i] = max(a)</code>			see wavestats

## Vector multiplication

R/S-Plus	MATLAB/Octave	IGOR	Description
<code>a*a</code>	<code>a.*a</code>	<code>a*a</code>	Multiply two vectors
	<code>dot(u,v)</code>	<code>matrixOP b = a . a</code>	Vector dot product, $u \cdot v$

## Matrices - \*\*\* IGOR is not a Matrix Friendly as MATLAB, see Multidimensional Waves and Matrix Math help topics

R/S-Plus	MATLAB/Octave	IGOR	Description
<code>rbind(c(2,3),c(4,5))</code> <code>array(c(2,3,4,5), dim=c(2,2))</code>	<code>a = [2 3;4 5]</code>		Define a matrix

## Concatenation (matrices); rbind and cbind

R/S-Plus	MATLAB/Octave	Description
<code>rbind(a,b)</code>	<code>[a ; b]</code>	Bind rows
<code>cbind(a,b)</code>	<code>[a , b]</code>	Bind columns
	<code>[a(:), b(:)]</code>	Concatenate matrices into one vector
<code>rbind(1:4,1:4)</code>	<code>[1:4 ; 1:4]</code>	Bind rows (from vectors)
<code>cbind(1:4,1:4)</code>	<code>[1:4 ; 1:4]'</code>	Bind columns (from vectors)

## Array creation

R/S-Plus	MATLAB/Octave	Description
<code>matrix(0,3,5)</code> Or <code>array(0,c(3,5))</code>	<code>zeros(3,5)</code>	0 filled array
<code>matrix(1,3,5)</code> Or <code>array(1,c(3,5))</code>	<code>ones(3,5)</code>	1 filled array
<code>matrix(9,3,5)</code> Or <code>array(9,c(3,5))</code>	<code>ones(3,5)*9</code>	Any number filled array
<code>diag(1,3)</code>	<code>eye(3)</code>	Identity matrix
<code>diag(c(4,5,6))</code>	<code>diag([4 5 6])</code>	Diagonal
	<code>magic(3)</code>	Magic squares; Lo Shu

## Reshape and flatten matrices

R/S-Plus	MATLAB/Octave	Description
<code>matrix(1:6,nrow=3,byrow=T)</code>	<code>reshape(1:6,3,2)'</code>	Reshaping (rows first)

<code>matrix(1:6,nrow=2)</code>	<code>reshape(1:6,2,3);</code>	Reshaping (columns first)
<code>array(1:6,c(2,3))</code>	<code>a'(:)</code>	Flatten to vector (by rows, like comics)
<code>as.vector(t(a))</code>	<code>a(:)</code>	Flatten to vector (by columns)
<code>as.vector(a)</code>	<code>vech(a)</code>	Flatten upper triangle (by columns)

## Shared data (slicing)

R/S-Plus	MATLAB/Octave	IGOR	Description
<code>b = a</code>	<code>b = a</code>	<code>duplicate a,b</code>	Copy of a

## Indexing and accessing elements (Python: slicing)

R/S-Plus	MATLAB/Octave	IGOR	Description
<code>a &lt;- rbind(c(11, 12, 13, 14), c(21, 22, 23, 24), c(31, 32, 33, 34))</code>	<code>a = [ 11 12 13 14 ... 21 22 23 24 ... 31 32 33 34 ]</code>		Input is a 3,4 array
<code>a[2,3]</code>	<code>a(2,3)</code>	<code>a[2][3]</code>	Element 2,3 (row,col)
<code>a[1,]</code>	<code>a(1,:)</code>	<code>a[1][]</code>	First row
<code>a[,1]</code>	<code>a(:,1)</code>	<code>a[][1]</code>	First column
	<code>a([1 3],[1 4]);</code>		Array as indices
<code>a[-1,]</code>	<code>a(2:end,:)</code>	<code>a[1,][]</code>	All, except first row
	<code>a(end-1:end,:)</code>	<code>a[dimsz(a,0)-3,] []</code>	Last two rows
	<code>a(1:2:end,:)</code>	<code>a[0,*;2][]</code>	Strides: Every other row
<code>a[-2,-3]</code>			All, except row,column (2,3)
<code>a[, -2]</code>	<code>a(:, [1 3 4])</code>	<code>deletpoints/M=1 0,1,a</code>	Remove one column

## Assignment

R/S-Plus	MATLAB/Octave	IGOR	Description
<code>a[,1] &lt;- 99</code>	<code>a(:,1) = 99</code>	<code>a[][1] = 99</code>	
<code>a[,1] &lt;- c(99,98,97)</code>	<code>a(:,1) = [99 98 97]'</code>		
<code>a[a&gt;90] &lt;- 90</code>	<code>a(a&gt;90) = 90;</code>	<code>a = a[p][q] &gt; 90 ? 90 : a[p][q]</code>	Clipping: Replace all elements over 90

## Transpose and inverse - SEE MatrixOP



R/S-Plus	MATLAB/Octave	Description
t(a)	a'	Transpose
	a.' or transpose(a)	Non-conjugate transpose
det(a)	det(a)	Determinant
solve(a)	inv(a)	Inverse
ginv(a)	pinv(a)	Pseudo-inverse
	norm(a)	Norms
eigen(a)\$values	eig(a)	Eigenvalues
svd(a)\$d	svd(a)	Singular values
	chol(a)	Cholesky factorization
eigen(a)\$vectors	[v,l] = eig(a)	Eigenvectors
rank(a)	rank(a)	Rank

## Sum

R/S-Plus	MATLAB/Octave	Description
apply(a,2,sum)	sum(a)	Sum of each column
apply(a,1,sum)	sum(a')	Sum of each row
sum(a)	sum(sum(a))	Sum of all elements
apply(a,2,cumsum)	cumsum(a)	Cumulative sum (columns)

## Sorting - MULTISTEP, see sort and MatrixOP

R/S-Plus	MATLAB/Octave	Description
	a = [ 4 3 2 ; 2 8 6 ; 1 4 7 ]	Example data
t(sort(a))	sort(a(:))	Flat and sorted
apply(a,2,sort)	sort(a)	Sort each column
t(apply(a,1,sort))	sort(a')'	Sort each row
	sortrows(a,1)	Sort rows (by first row)
order(a)		Sort, return indices

## Maximum and minimum

R/S-Plus	MATLAB/Octave	Description
apply(a,2,max)	max(a)	max in each column
apply(a,1,max)	max(a')	max in each row
max(a)	max(max(a))	max in array
i <- apply(a,1,which.max)	[v i] = max(a)	return indices, i
pmax(b,c)	max(b,c)	pairwise max
apply(a,2,cummax)	cummax(a)	

## Matrix manipulation - See MatrixOP

R/S-Plus	MATLAB/Octave	Description
<code>a[,4:1]</code>	<code>fliplr(a)</code>	Flip left-right
<code>a[3:1,]</code>	<code>flipud(a)</code>	Flip up-down
	<code>rot90(a)</code>	Rotate 90 degrees
<code>kroncker(matrix(1,2,3),a)</code>	<code>repmat(a,2,3)</code> <code>kron(ones(2,3),a)</code>	Repeat matrix: [ a a a ; a a a ]
<code>a[lower.tri(a)] &lt;- 0</code>	<code>triu(a)</code>	Triangular, upper
<code>a[upper.tri(a)] &lt;- 0</code>	<code>tril(a)</code>	Triangular, lower

## Equivalents to "size"

R/S-Plus	MATLAB/Octave	IGOR	Description
<code>dim(a)</code>	<code>size(a)</code>	<code>dimsize(a,#)</code> 0 rows, 1 cols, etc.	Matrix dimensions
<code>ncol(a)</code>	<code>size(a,2)</code> or <code>length(a)</code>	<code>dimsize(a,1)</code>	Number of columns
<code>prod(dim(a))</code>	<code>length(a(:))</code>	<code>numpnts(a)</code>	Number of elements
	<code>ndims(a)</code>	<code>if(dimsize(a,#) == 0)</code>	Number of dimensions
<code>object.size(a)</code>		see Data Browser	Number of bytes used in memory

## Matrix- and elementwise- multiplication - see MatrixOP

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> or <code>a %o% b</code>		Outer product
<code>crossprod(a,b)</code> or <code>t(a) %*% b</code>		Cross product
<code>kroncker(a,b)</code>	<code>kron(a,b)</code>	Kronecker product
	<code>a / b</code>	Matrix division, $\{a\} \cdot a^{-1}$
<code>solve(a,b)</code>	<code>a \ b</code>	Left matrix division, $a^{-1} \cdot a$ \newline (solve linear equations)

## Find; conditional indexing - SEE ?: (conditional operator), may be multi step

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 &lt;- which(a != 0, arr.ind=T); v &lt;- a[ij]</code>	<code>[i j v] = find(a)</code>	Vector of non-zero values
<code>which(a&gt;5.5)</code>	<code>find(a&gt;5.5)</code>	Condition, indices
<code>ij &lt;- which(a&gt;5.5, arr.ind=T); v &lt;- a[ij]</code>		Return values

a .\* (a>5.5)      Zero out elements above 5.5

## Multi-way arrays

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

## File input and output - Data:Load Waves, Open, and FbinRead, etc.

R/S-Plus	MATLAB/Octave	Description
f <- read.table("data.txt")	f = load('data.txt')	Reading from a file (2d)
f <- read.table("data.txt")	f = load('data.txt')	Reading from a file (2d)
f <- read.table(file="data.csv", sep=";")	x = dlmread('data.csv', ';')	Reading from a CSV file (2d)
write(f, file="data.txt")	save -ascii data.txt f	Writing to a file (2d)

## Plotting

### Basic x-y plots

R/S-Plus	MATLAB/Octave	IGOR	Description
plot(a, type="l")	plot(a)	display a	1d line plot
plot(x[,1], x[,2])	plot(x(:,1), x(:,2), 'o')	display a vs b	2d scatter plot
	plot(x1, y1, x2, y2)	display a, b	Two graphs in one plot
plot(x1, y1)	plot(x1, y1)	display a; appendtograph	Overplotting: Add new
matplot(x2, y2, add=T)	hold on	b	plots to current
	subplot(211)		subplots
plot(x, y, type="b", col="red")	plot(x, y, 'ro-')	double click graph	Plotting symbols and color

## Axes and titles - double click axis - all changes are printed to command history as command line syntax

R/S-Plus	MATLAB/Octave	Description
grid()	grid on	Turn on grid lines
plot(c(1:10, 10:1), asp=1)	axis equal axis('equal') replot	1:1 aspect ratio
plot(x, y, xlim=c(0,10), ylim=c(0,5))	axis([ 0 10 0 5 ])	Set axes manually
	title('title')	

<code>plot(1:10, main="title", xlab="x-axis", ylab="y-axis")</code>	<code>xlabel('x-axis') ylabel('y-axis')</code>	Axis labels and titles
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## Log plots

R/S-Plus	MATLAB/Octave	Description
<code>plot(x,y, log="y")</code>	<code>semilogy(a)</code>	logarithmic y-axis
<code>plot(x,y, log="x")</code>	<code>semilogx(a)</code>	logarithmic x-axis
<code>plot(x,y, log="xy")</code>	<code>loglog(a)</code>	logarithmic x and y axes

## Filled plots and bar plots

R/S-Plus	MATLAB/Octave	Description
<code>plot(t,s, type="n", xlab="", ylab="")</code>	<code>fill(t,s,'b', t,c,'g')</code>	Filled plot
<code>polygon(t,s, col="lightblue")</code>	<code>% fill has a bug?</code>	
<code>polygon(t,c, col="lightgreen")</code>		
<code>stem(x[,3])</code>		Stem-and-Leaf plot

## Functions

R/S-Plus	MATLAB/Octave	IGOR	Description
<code>f &lt;- function(x) sin(x/3) - cos(x/5)</code>	<code>f = inline('sin(x/3) - cos(x/5)')</code>	<code>make a=sin(x/3 - cos(x/5)</code>	Defining functions
<code>plot(f, xlim=c(0,40), type='p')</code>	<code>ezplot(f,[0,40]) fplot('sin(x/3) - cos(x/5)', [0,40]) % no ezplot</code>	<code>128 points, /N specifies desired number</code>	Plot a function for given range

## Polar plots - CTRL (CMD) + M, #include <New Polar Graphs>; Windows:New:Polar Graph

R/S-Plus	MATLAB/Octave	Description
<code>theta = 0:.001:2*pi; r = sin(2*theta); polar(theta, rho)</code>		

## Histogram plots - Analysis:Histogram

R/S-Plus	MATLAB/Octave	Description
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<code>hist(rnorm(1000))</code>	<code>hist(randn(1000,1))</code>
<code>hist(rnorm(1000), breaks= -4:4)</code>	<code>-4:4)</code>
<code>hist(rnorm(1000), breaks=c(seq(-5,0,0.25), seq(0.5,5,0.5)), freq=F)</code>	
<code>plot(apply(a,1,sort),type="l")</code>	<code>plot(sort(a))</code>

### 3d data - Windows:New:3D Plots

### Contour and image plots - Windows:New:Contour Plot

R/S-Plus	MATLAB/Octave	IGOR	Description
<code>contour(z)</code>	<code>contour(z)</code>		Contour plot
<code>filled.contour(x,y,z, nlevels=7, color=gray.colors)</code>	<code>contourf(z); colormap(gray)</code>		Filled contour plot
<code>image(z, col=gray.colors(256))</code>	<code>image(z) colormap(gray)</code>	<code>newimage z</code> <code>OR</code> <code>display;appendimage z</code>	Plot image data
	<code>quiver()</code>		Direction field vectors

### Perspective plots of surfaces over the x-y plane - LOOK IT UP

R/S-Plus	MATLAB/Octave	Description
<code>f &lt;- function(x,y) x*exp(-x^2-y^2)</code> <code>n &lt;- seq(-2,2, length=40)</code> <code>z &lt;- outer(n,n,f)</code> <code>persp(x,y,z, theta=30, phi=30, expand=0.6, ticktype='detailed')</code>	<code>n=-2:.1:2;</code> <code>[x,y] = meshgrid(n,n);</code> <code>z=x.*exp(-x.^2-y.^2);</code>  <code>mesh(z)</code>	Mesh plot
<code>persp(x,y,z, theta=30, phi=30, expand=0.6, col='lightblue', shade=0.75, ltheta=120, % no surf1() ticktype='detailed')</code>	<code>surf(x,y,z) OR surf1(x,y,z)</code>	Surface plot

### Scatter (cloud) plots - GIZMO

R/S-Plus	MATLAB/Octave	Description
<code>cloud(z~x*y)</code>	<code>plot3(x,y,z, 'k')</code>	3d scatter plot

**Save plot to a graphics file - File:Save Graphics, or Edit:Export Graphics to select format, CTRL (CMD) + C works too**

R/S-Plus	MATLAB/Octave	Description
	<code>plot(1:10)</code> <code>print -depsc2 foo.eps</code>	

<code>postscript(file="foo.eps")</code>	<code>gset output "foo.eps"</code>	PostScript
<code>plot(1:10)</code>	<code>gset terminal postscript</code>	
<code>dev.off()</code>	<code>eps</code>	
	<code>plot(1:10)</code>	
<code>pdf(file='foo.pdf')</code>		PDF
<code>devSVG(file='foo.svg')</code>		SVG (vector graphics for www)
<code>png(filename = "Rplot%03d.png")</code>	<code>print -dpng foo.png</code>	PNG (raster graphics)

## Data analysis

### Set membership operators

R/S-Plus	MATLAB/Octave	Description
<code>a &lt;- c(1,2,2,5,2)</code>	<code>a = [ 1 2 2 5 2 ];</code>	Create sets
<code>b &lt;- c(2,3,4)</code>	<code>b = [ 2 3 4 ];</code>	
<code>unique(a)</code>	<code>unique(a)</code>	Set unique
<code>union(a,b)</code>	<code>union(a,b)</code>	Set union
<code>intersect(a,b)</code>	<code>intersect(a,b)</code>	Set intersection
<code>setdiff(a,b)</code>	<code>setdiff(a,b)</code>	Set difference
<code>setdiff(union(a,b),intersect(a,b))</code>	<code>setxor(a,b)</code>	Set exclusion
<code>is.element(2,a) or 2 %in% a</code>	<code>ismember(2,a)</code>	True for set member

### Statistics - See `wavestats`, `imagestats`, and every `Functions:Statistics` in help browser

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 &lt;- lm(y~x)</code>	<code>z = polyval(polyfit(x,y,1),x)</code>	Straight line fit
<code>plot(x,y)</code>	<code>plot(x,y,'o', x,z,'-')</code>	
<code>abline(z)</code>		
<code>solve(a,b)</code>	<code>a = x\y</code>	Linear least squares $y = ax + b$
	<code>polyfit(x,y,3)</code>	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>	Find zeros of polynomial
	<code>f = inline('1/x - (x-1)')</code> <code>fzero(f,1)</code>	Find a zero near $x = 1$
	<code>solve('1/x = x-1')</code>	Solve symbolic equations
	<code>polyval([1 2 1 2],1:10)</code>	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 - Analysis:FFT

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

## Symbolic algebra; calculus

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

## Programming - CTRL (CMD) + M to bring up local procedure window, enter functions or #includes here

R/S-Plus	MATLAB/Octave	IGOR	Description
<code>.R</code>	<code>.m</code>	<code>.ipf</code>	Script file extension
<code>#</code>	<code>%</code> <code>% or #</code>	<code>//</code>	Comment symbol (rest of line)
<code>library(RSvgDevice)</code>	<code>% must be in MATLABPATH</code> <code>% must be in LOADPATH</code>	<code>#include "Name"</code>  <code>without .ipf, must be in User Procedures folder.</code>	Import library functions
<code>string &lt;- "a &lt;- 234"</code> <code>eval(parse(text=string))</code>	<code>string='a=234';</code> <code>eval(string)</code>		Eval

## Loops

R/S-Plus	MATLAB/Octave	IGOR	Description
		for(i=0;i<10;i+=1)	
for(i in 1:5) print(i)	for i=1:5; disp(i); end	print i endfor	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	IGOR	Description
		if (1 > 0)	
if (1>0) a <- 100	if 1>0 a=100; end	a = 100 endif	if-statement
		if (1 < 0)	
		a = 100	
	if 1>0 a=100; else a=0; end	else	if-else-statement
		a = 0 endif	
ifelse(a>0,a,0)		a = a[] > 0 ? a[p] : 0	Ternary operator (if?true:false)

## Debugging

R/S-Plus	MATLAB/Octave	IGOR	Description
.Last.value	ans	arrow up	Most recent evaluated expression
objects()	whos or who	Data:Data Browser	List variables loaded into memory
rm(x)	clear x or clear [all]	Killvariables, killstrings, killwaves	Clear variable \$x\$ from memory
print(a)	disp(a)	print a	Print

## Working directory and OS



<b>R/S-Plus</b>	<b>MATLAB/Octave</b>	<b>IGOR</b>	<b>Description</b>
<code>list.files()</code> or <code>dir()</code>	<code>dir</code> or <code>ls</code>	Data:Data Browser	List files in directory
<code>list.files(pattern="\.r\$")</code>	<code>what</code>	Window:Procedure Windows	List script files in directory
<code>getwd()</code>	<code>pwd</code>	all data saved with .pxp file, unless unpacked experiments selected	Displays the current working directory
<code>setwd('foo')</code>	<code>cd foo</code>	N/A	Change working directory
<code>system("notepad")</code>	<code>!notepad</code> <code>system("notepad")</code>	see documentation	Invoke a System Command

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

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