DR. CLARK'S REFERENCE CARD FOR GETTING STARTED WITH R

Object *classes*: Very important!! Determine how R will handle that object: as.numeric(), as.integer(), as.character(), as.factor()

Operators		
<-	Assignment operator.	
> , < , >=	Greater, less than, not equal to	
, <= , !=		
#	Comment symbol	
" " or ' '	Use to surround text strings	
,	(comma) Separator between items	
	Missing data. If your data contain "NA"s they may affect	
NA	calculations. Many functions accept the argument	
	na.rm=T	
1:3	the vector 1, 2, 3	
+, -, /,	Typical math notation for addition, subtraction, division,	
*, ^	multiplication, exponents	
~	Formula symbol to use instead of equal sign in formulas	
	(e.g. y ~ x)	

General functions

c()	Create a vector of the specified elements inside	
which()	Find elements inside a vector that satisfy a	
	condition	
str()	Learn more about the structure of an object	
head() or tail()	View the first or last 6 entries in a data.frame	
help()	Access the help documentation for a function	
<pre>install.package()</pre>	Install a new package for the first time	
library()	Load an installed package	
summary()	Output depends on the nature of the object	
	provided	
sqrt()	Take the square root	
log()	Takes the <u>natural</u> log In	
class()	Get information about or set the "class" of an object	
data()	Load a provided dataset	
View(m1)	view data frame m1	

Indexing	
m1[r1, c1]	view entry at row 1, column 1, where
	r1 and c1 are numbers
m1[, c1]	view entirety of column 1
m1[, 1:3]	Select or view first three columns

m1\$a1	Also view entirety of column 1, where
	a1 is a column name
m1[, "a1"]	Also selects column named a1, where
	a1 is a name
m1[, c("a1", "a2",	Select columns a1, a2, and a3 by
"a3")]	name
<pre>m1[which(m1\$a1 ==</pre>	For all rows of column a1 that equal
"thing"), "a2"]	"thing," display value for entry in
	column a2

Plotting functions

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hist()	Frequency histogram
$plot(y \sim x)$, $plot(x, y)$	Scatter and line plots
plot(y ~ x, type = "l")	Line plot without points
$plot(y \sim x, type = "b")$	Lines and points plotted
points()	Add points to existing plot
	(overlay)
abline()	Lines from a to b.
barplot()	Barplots
<pre>boxplot(y ~ x),</pre>	Boxplots
<pre>boxplot(y ~ x * z)</pre>	
<pre>axis(side=1, at=1:3,</pre>	Create a "custom" plot axis
tick=TRUE, c("label 1",	
"label 2", "label 3")	
<pre>mtext()</pre>	Add text to the margins of a plot
par(mfrow = c(1, 2))	Create a 2-panel figure with 1 row
	and 2 columns
legend("bottomright",	Add a legend to the plot
<pre>fill=c("red", "blue"),</pre>	
<pre>legend = c("first</pre>	
<pre>thing", "second thing"))</pre>	
<pre>pdf("filename.pdf",</pre>	Will save your plot as a pdf with
<pre>pdf("filename.pdf", height=5, width=4)</pre>	Will save your plot as a pdf with dimensions that you specify
<pre>pdf("filename.pdf", height=5, width=4) # plot drawing</pre>	Will save your plot as a pdf with dimensions that you specify.
<pre>pdf("filename.pdf", height=5, width=4) # plot drawing commands</pre>	Will save your plot as a pdf with dimensions that you specify.

Graphical parameters – add as arguments to plotting functions above

xaxt	If xaxt="n" the x-axis is set but not drawn (useful in conjunction with axis(side=1,)	
main	Main title	
xlab, ylab	Label for x axis or y axis	
xlim, ylim	Axis limits for x and y axis	
col	Color. Check colorbrewer.org for good color	
	schemes.	

DR. CLARK'S REFERENCE CARD FOR GETTING STARTED WITH R

lwd	line width
pch	Symbol shape
cex	Symbol size

Descriptive Statistics

<pre>max(), min(), mean(), median(), sum(), var(), sd(), range()</pre>	Refer to Guidelines for what each of these means
<pre>sd(x) / sqrt(length(x))</pre>	Calculate the standard error of the mean (no built-in function for this)
summary(data.frame)	Summary information for all columns in a data frame
<pre>tapply(x1, list1, function1)</pre>	Apply function to x1 by list1

Comparative Statistics

<pre>aov(y1 ~ x1 * x2, data=m1), anova(y1 ~ x1 * x2, data=m1)</pre>	Two-way Analysis of Variance of response variable y1 as it relates to factors x1 and x2, including the interaction term.
<pre>summary(aov.object) or summary(aov(y~x))</pre>	Returns statistical results of Analysis of Variance object
TukeyHSD(aov(y~x))	Post-hoc pairwise Tukey test for the Anova specified
lm(y1 ~ x1, data=m1)	Linear regression of response variable y1 as related to continuous predictor variable x1
<pre>summary(lm.object) or summary(lm(y~x))</pre>	Returns statistical results of linear regression object
<pre>t.test(y ~ x, data=m1) or t.test(m1\$y, m2\$y)</pre>	Unpaired, two-sided t-test. See guidelines for one-sided tests.
<pre>t.test(y ~ x, data=m1, paired="true")</pre>	Paired t-test
chisq.test()	Method for calculating a chi-squared statistic in R. Recommend you calculate this by hand instead.

Advanced Methods: Line plots for 2 or more lines that include points, lines, and error bars. Assumes each treatment group is in its own dataset named "tx1" etc, which contains a column that indicates the x-axis position called "xvar" and another column with the measurement of interest called "yvar"

library("tidyverse") # run install.packages() the first time to install this package

Calculate standard deviation for first treatment group. Repeat process for subsequent treatment groups.

```
txlsd <- txl %>%
group_by(xvar) %>%
summarise(meany = mean(yvar), sdy = sd(yvar))
```

```
# Start plot:
plot(tx1sd$meany ~ tx1sd$xvar, ...)
```

```
# Overlay next lines for next treatment group:
points(tx2sd$meany ~ tx2sd$xvar, ...)
```

```
# Add standard error bars for each treatment group:
arrows(txlsd$xvar, txlsd$meany - txlsd$sdy, txlsd$xvar,
txlsd$meany + txlsd$sdy, length = 0.05, angle = 90, code = 3)
```