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Enough R for Intro to Statistical Modeling

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A couple dozen functions suffice to carry out your work in Introduction to Statistical Modeling. This sheet provides the names of functions, a review of formula syntax, and some examples of use.

Help

```
help()
apropos()
?
??
example()
```

Arithmetic

Basic arithmetic is very similar to a calculator.

```
# basic ops: + - * / ^ ( )
log()
exp()
sqrt()
log10()
abs()
```

Randomization/Iteration

```
do()          # mosaic
sample()      # mosaic augmented
resample()    # with replacement
shuffle()     # mosaic
```

Graphics

```
bwplot()
xyplot()
densityplot()
histogram()
plotFun() # mosaic
```

Numerical Summaries

These functions have a formula interface to match plotting.

```
mean()   # mosaic augmented
median() # mosaic augmented
sd()     # mosaic augmented
var()    # mosaic augmented
tally()  # mosaic
qdata()  # mosaic
pdata()  # mosaic
IQR()
```

Model Building and Inference

```
mm()       # mosaic
lm()       # linear models
glm()      # for logistic models
resid()
fitted()
confint()
anova()
summary()
makeFun() # mosaic
listFun() # devel
```

Interactive

```
mLM()
mLineFit()
mCI()
mLinAlgebra()
mHypTest()
mPower()
```

Formula Theme

The following syntax (often with some parts omitted) is used for graphical summaries and numerical summaries.

```
fname( y ~ x | z, data=...,
                  groups=... )
```

For plots

- y: is y-axis variable
- x: is x-axis variable
- z: conditioning variable (separate panels)
- groups: conditioning variable (overlaid graphs)

For other things y x — z can usually be read y or depends on x separately for each z .

Data and Variables

```
fetchData()   # mosaic
names()
head()
levels()
subset()
with()
transform()
as.factor()
merge()
rank()
```

Model Terms

```
# All cases the same:
response ~ 1
# Main effects & intercept
response ~ X + Y
# Exclude intercept
# (Rarely used.  Be careful!)
response ~ X + Y - 1
# Main effects and interaction:
response ~ X * Y
# Pure interaction (Rarely used.)
response ~ X:Y
#Polynomial terms:
response ~ poly(X,2)
# Random model vectors (pedagogical)
response ~ rand(2) # mosaic
```

Common Example Datasets

Can be used directly with `data=`:

```
Galton # heights
CPS85 # wages
KidsFeet
Marriage
SAT
```

Read in with `fetchData()`:

```
utils = fetchData("utilities.csv")
alder = fetchData("alder.csv")
grades = fetchData("grades.csv")
courses = fetchData("courses.csv")
# Load software in development:
fetchData("m155development.R")
```

Tallying

A simple count of the number in each level

```
tally(~sex, data = CPS85)
```

A two-way table of counts

```
tally(~sex + married, data = CPS85)
```

Conditional proportions: A | B means "A conditioned on B".

```
tally(~sex | married, data = CPS85)
```

Different from `~married|sex`.

New Dataframe Variable

```
g = fetchData("Galton")
```

Add a variable named `mid`

```
g = transform(g,
     mid=(father+1.08*mother)/2)
names(g)  #confirm that it's there

[1] "family" "father" "mother" "sex"
[5] "height" "nkids"  "mid"
```

Subsets

Sometimes you want only part of a data set.

```
boys = subset(KidsFeet, sex=="B")
elig = subset(CPS85,
        wage>10 & married=="Single")
pros = subset(CPS85,
  sector %in% c("prof","manag"))
```

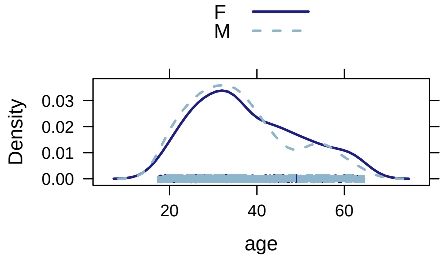
Distributions

Simple distribution

```
densityplot(~age, data = CPS85)
```

Overlaying two (or more) groups

```
densityplot( ~ age, groups=sex,
             data=CPS85,
             auto.key=TRUE)
```



Side-by-side plots:

```
densityplot(~age | sex, data = CPS85)
```

```
bwplot(age ~ sector, data = CPS85)
```

Scatter Plots

```
xyplot(wage ~ age, data = CPS85)
```

`groups=` and `|` work as with `densityplot()`.

P's and Q's

Want to find the value that separates the lower 30% from the higher 70%:

```
qdata(0.3, wage, data = CPS85)

 30%
5.71
```

Have a value and want to find what fraction of the cases are at or below the value:

```
pdata(10, wage, data = CPS85)

[1] 0.6891
```

Confidence Intervals

... via "normal theory"

```
mod = lm( wage ~ educ, data=CPS85 )
confint(mod)

              2.5 % 97.5 %
(Intercept) -2.7997 1.3077
educ         0.5958 0.9051
```

See also `summary(mod)`.

... via bootstrapping

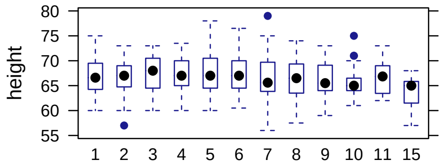
```
s = do(500)*
  lm(wage~educ, data=resample(CPS85))
sd(s) # standard error

Intercept      educ     sigma r.squared
  1.03327   0.08563   0.28541   0.02843
```

See also `confint(s)`

Quantitative → Categorical

```
bwplot( height ~ as.factor(nkids),
        data=Galton )
```



Something is Wrong

```
run = fetchData("repeat-runners.csv")
mean(net, data = run)

[1] NA
```

Some of the data was missing, thus the NA. **The FIX**:

```
options(na.rm = TRUE)
mean(net, data = run)

[1] 88.27
```