```
# error messages
libary(datasets)
data(airquality)
cor(airquality)

# vector function
a <- vector(mode="integer", 2)
class(a)

# printing values
x <- 1
print(x)
# autoprint
x

msg <- "hello"
msg

x <- 1:20
x

# vector creation with c() function
x <- c(0.6, 0.6)       # numeric
x <- c(TRUE, FALSE)    # logical
x <- c(T, F)           # logical
x <- c("a", "b", "c")  # character
x <- c 9:29            # integer
x <- c(1+0i, 2+4i)     # complex

x
class(x)

# mixing objects
y <- c(1.7, "a")   # character
y <- c(TRUE, 2)    # numeric
y <- c("a", TRUE)  # character

class(y)

# explicit coercion
x <- 0:6
class(x)

v <- as.numeric(x)
v <- as.logical(x)
v <- as.character(x)
class(v)

# NAs
x <- c("a", "b", "c")
as.numeric(x)

# Matrices are vectors with a dimension attribute
# the dimension is a vector of length 2(nrow, ncol)
```

```
m <- matrix(nrow=2, ncol=3)
m
# [,1] [,2] [,3]
# [1,]   NA   NA   NA
# [2,]   NA   NA   NA
dim(m)
#[1] 2 3
attributes(m)
# $dim
# [1] 2

m <- matrix(1:6, nrow=2, ncol=3)
m
# [,1] [,2] [,3]
# [1,]    1    3    5
# [2,]    2    4    6

m <- 1:10
dim(m) <- c(2,5)
m

x <- 1:3
y <- 10:12

# column binding
cbind(x, y)
#      x  y
# [1,] 1 10
# [2,] 2 11
# [3,] 3 12

# row binding
rbind(x, y)
#    [,1] [,2] [,3]
# x    1    2    3
# y   10   11   12

x <- list(1, "a", TRUE, 1+4i)
class(x)
x

# [[1]]
# [1] 1

# [[2]]
# [1] "a"

# [[3]]
# [1] TRUE

# [[4]]
# [1] 1+4i


# Factors to represent categorical data
```

```
# treated specially by functions like lm() and glm()
# e.g. Male and Female
# is an integer vector
x <- factor(c("yes", "yes", "no", "yes", "no"))
x
# [1] yes yes no  yes no
# Levels: no yes

table(x)
# x
# no yes
# 2   3

unclass(x)
# [1] 2 2 1 2 1
# attr(,"levels")
# [1] "no"  "yes"

x <- factor(c("yes", "yes", "no", "yes", "no"), levels= c("yes",
"no"))
x
table(x)
# x
# yes  no
#   3   2

# Missing values
x <- c(1, 2, NA, 10, 3)
is.na(x)
is.nan(x)

# NaN is also NA but NA is not an NaN
x <- c(1, 2, NaN, NA, 4)
is.na(x)
is.nan(x)

# data frames are used to store tabular data
# unlike matrices they can store different kinds of classes
# saved as list
# attributes
#  row.names
#  read.table() or read.csv()
#  converted to matrix by calling data.matrix()
x <- data.frame(foo=1:4, bar= c(T, T, F, F))
x
#    foo   bar
# 1   1  TRUE
# 2   2  TRUE
# 3   3 FALSE
# 4   4 FALSE
nrow(x)
# [1] 4
ncol(x)
# [1] 2
```

```
# Names
x <- 1:3
names(x) <- c("foo", "bar", "norf")
x
# foo  bar norf
# 1    2    3

# lists can also have names
x <- list(a =1, b=2, c=3)
x
# $a
# [1] 1

# $b
# [1] 2

# $c
# [1] 3

# matrices can have names
m <- matrix(1:4, nrow=2, ncol=2)
dimnames(m)
dimnames(m) <- list(c("a", "b"), c("c", "d"))
m
#   c d
# a 1 3
# b 2 4

# subsetting
# [  always returns an object of the same class
# [[ single element of list or data frame
# $ to extract elements from list or data frame
x <- c("a", "b", "c", "c", "d", "a")
x[1]
# [1] "a"
x[2]
# [1] "b"
x[1:4]
# [1] "a" "b" "c" "c"
x[x > "a"]
[1] "b" "c" "c" "d"
u <-  x > "a"
u
# [1] FALSE  TRUE  TRUE  TRUE  TRUE FALSE
x[u]

# subsetting a matrix
x <- matrix(1:6, 2, 3)
x[1, 2]
# [1] 3
x[2, 1]
# [1] 2

# missing indices
x[1, ]
```

```
# [1] 1 3 5
x[, 2]
# [1] 3 4

# subsetting a matrix
x <- matric(1:6, 2, 3)

# returns a vector
x[1, 2]
# [1] 3
class(x[1,2])
# [1] "integer"

# returns a matrix
class(x[1,2, drop = FALSE])
# [1] "matrix"

x <- matrix(1:6, 2, 3)
x[1,]
# [1] 1 3 5
x[1, , drop = FALSE]
# [,1] [,2] [,3]
# [1,]    1    3    5

# subsetting lists
x <- list(foo = 1:4, bar = 0.6)
# returns a list
x[1]
# $foo
# [1] 1 2 3 4
class(x[1])
# [1] "list"

x[[1]]
# [1] 1 2 3 4
class(x[[1]])
#

> x <- 1
> print(x)
[1] 1
> x
[1] 1
> x
[1] 1
> x <- 1
> print(x)
[1] 1
> msg <- "hello"
> msg
[1] "hello"
> x <- 1:20
> x
[1]  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19
[20] 20
```

```
> x <- c(1+0i, 2+4i)
> x
[1] 1+0i 2+4i
> class(x)
[1] "complex"
> x <- c("a", "b", "c")
> x <- c(T, F)
> x
[1]  TRUE FALSE
> x <- c(0.6, 0.6)
> x
[1] 0.6 0.6
> y <- c(1.7, "a")
> y
[1] "1.7" "a"
> class(y)
[1] "character"
> y <- c("a", TRUE)
> class(y)
[1] "character"
> y <- c(TRUE, 2)
> class(y)
[1] "numeric"
> x <- 0:6
> class(x)
[1] "integer"
> as.numeric(x)
[1] 0 1 2 3 4 5 6
> class(x)
[1] "integer"
> v <- as.numeric(x)
> class(v)
[1] "numeric"
> v <- as.logical(x)
> v
[1] FALSE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
> v <- as.character(x)
> v
[1] "0" "1" "2" "3" "4" "5" "6"
> x <- c("a", "b", "c")
> as.numeric(x)
[1] NA NA NA
Warning message:
  NAs introduced by coercion
> m <- matrix(nrow=2, ncol=3)
> m
[,1] [,2] [,3]
[1,]   NA   NA   NA
[2,]   NA   NA   NA
> dim(m)
[1] 2 3
> attributes(m)
$dim
[1] 2 3
```

```
> m <- matrix(1:6, nrow=2, ncol=3)
> m
[,1] [,2] [,3]
[1,]    1    3    5
[2,]    2    4    6
> m <- 1:10
> dim(m) <- c(2,5)
> m
[,1] [,2] [,3] [,4] [,5]
[1,]    1    3    5    7    9
[2,]    2    4    6    8   10
> stats(m)
Error: could not find function "stats"
> summary(m)
V1              V2              V3              V4
Min.   :1.00   Min.   :3.00   Min.   :5.00   Min.   :7.00
1st Qu.:1.25   1st Qu.:3.25   1st Qu.:5.25   1st Qu.:7.25
Median :1.50   Median :3.50   Median :5.50   Median :7.50
Mean   :1.50   Mean   :3.50   Mean   :5.50   Mean   :7.50
3rd Qu.:1.75   3rd Qu.:3.75   3rd Qu.:5.75   3rd Qu.:7.75
Max.   :2.00   Max.   :4.00   Max.   :6.00   Max.   :8.00
V5
Min.   : 9.00
1st Qu.: 9.25
Median : 9.50
Mean   : 9.50
3rd Qu.: 9.75
Max.   :10.00
> x <- 1:3
> y <- 10:12
>
  > cbind(x, y)
x  y
[1,] 1 10
[2,] 2 11
[3,] 3 12
> rbind(x, y)
[,1] [,2] [,3]
x    1    2    3
y   10   11   12
> x <- list(1, "a", TRUE, 1+4i)
> class(x)
[1] "list"
> x
[[1]]
[1] 1

[[2]]
[1] "a"

[[3]]
[1] TRUE

[[4]]
[1] 1+4i
```

```
> x <- factor("yes", "yes", "no", "yes", "no")
Error in if (ordered) "ordered" :
  argument is not interpretable as logical
> x
[[1]]
[1] 1

[[2]]
[1] "a"

[[3]]
[1] TRUE

[[4]]
[1] 1+4i

> x <- factor(c("yes", "yes", "no", "yes", "no"))
> x
[1] yes yes no  yes no
Levels: no yes
> table(x)
x
no yes
2   3
> unclass(x)
[1] 2 2 1 2 1
attr(,"levels")
[1] "no"  "yes"
> x <- factor(c("yes", "yes", "no", "yes", "no"), levels= c("yes",
"no"))
> x
[1] yes yes no  yes no
Levels: yes no
> table(x)
x
yes  no
3   2
> x <- c(1, 2, NA, 10, 3)
> is.na(x)
[1] FALSE FALSE  TRUE FALSE FALSE
> is.nan(x)
[1] FALSE FALSE FALSE FALSE FALSE
> x <- c(1, 2, NaN, Na, 4)
Error: object 'Na' not found
> x <- c(1, 2, NaN, NA, 4)
> x <- c(1, 2, NaN, NA, 4)
> is.na(x)
[1] FALSE FALSE  TRUE  TRUE FALSE
> is.nan(x)
[1] FALSE FALSE  TRUE FALSE FALSE
> x <- data.frame(foo=1:4, bar= c(T, T, F, F))
> x
foo   bar
1   1  TRUE
```

```
2   2  TRUE
3   3 FALSE
4   4 FALSE
> nrow(x)
[1] 4
> ncol(x)
[1] 2
> x <- 1:3
> x
[1] 1 2 3
> x <- 1:3
> names(x) <- c("foo", "bar", "norf")
> x
foo  bar norf
1    2    3
> x <- list(a =1, b=2, c=3)
> x
$a
[1] 1

$b
[1] 2

$c
[1] 3

> m <- matrix(1:4, nrow=2, ncol=2)
> dimnames(m)
NULL
> dimnames(m) <- list(c("a", "b"), c("c", "d"))
> m
c d
a 1 3
b 2 4
> x <- c("a", "b", "c", "c", "d", "a")
> x[1]
[1] "a"
> x[2]
[1] "b"
> x[1:4]
[1] "a" "b" "c" "c"
> x[x > "a"]
[1] "b" "c" "c" "d"
> u <-  x > "a"
> u
[1] FALSE  TRUE  TRUE  TRUE  TRUE FALSE
> x[u]
[1] "b" "c" "c" "d"
> x[1, 2]
Error in x[1, 2] : incorrect number of dimensions
> x[1, 2]
Error in x[1, 2] : incorrect number of dimensions
> x <- matrix(1:6, 2, 3)
> x[1, 2]
[1] 3
```

```
> x[2, 1]
[1] 2
> x[1, ]
[1] 1 3 5
> x[, 2]
[1] 3 4
> x[1, 2]
[1] 3
> class(x[1,2])
[1] "integer"
> class(x[1,2, drop = FALSE])
[1] "matrix"
> x <- matrix(1:6, 2, 3)
> x[1,]
[1] 1 3 5
> x[1, , drop = FALSE]
[,1] [,2] [,3]
[1,]    1    3    5
> x[1]
[1] 1
> x <- list(foo = 1:4, bar = 0.6)
> x[1]
$foo
[1] 1 2 3 4

> x[[1]]
[1] 1 2 3 4
> class(x[1])
[1] "list"

x[[1]]
# [1] 1 2 3 4
> class(x[[1]])
[1] "integer"

x$bar
# [1] 0.6
x[["bar"]]
# [1] 0.6
x["bar"]
# [1] 0.6

# multiple elements in a list
x <- list(foo = 1:4, bar = 0.6, baz = "hello")
x[c(1,3)]
# $foo
# [1] 1 2 3 4

# $baz
# [1] "hello"

x <- list(foo = 1:4, bar = 0.6, baz = "hello")

name <- "foo"
x[[name]]
```

```
# [1] 1 2 3 4

x$name
# NULL

x <- list(a = list(10, 12, 14), b= c(3.4, 2.81))
x[[c(1,3)]]
# [1] 14
x[[1]][[3]]
# [1] 14
x[[c(2,1)]]
# [1] 3.4

# partial matching
x <- list(aardvark = 1:5)
x$a
# [1] 1 2 3 4 5
x[["a"]]
# NULL
x[["a", exact="FALSE"]]
# [1] 1 2 3 4 5

# Removing NA values
x <- c(1, 2, NA, 4, NA, 5)
bad <- is.na(x)
x[!bad]

x <- c(1, 2, NA, 4, NA, 5)
y <- c("a", "b", NA, "d", NA, "f")
good <- complete.cases(x, y)
good
# [1]  TRUE  TRUE FALSE  TRUE FALSE  TRUE
x[good]
# [1] 1 2 4 5
y[good]
# [1] "a" "b" "d" "f"

library(datasets)
data(airquality)
airquality[1:6,]
#    Ozone Solar.R Wind Temp Month Day
# 1    41     190  7.4   67     5   1
# 2    36     118  8.0   72     5   2
# 3    12     149 12.6   74     5   3
# 4    18     313 11.5   62     5   4
# 5    NA      NA 14.3   56     5   5
# 6    28      NA 14.9   66     5   6

good <- complete.cases(airquality)
airquality[good, ][1:6,]
#   Ozone Solar.R Wind Temp Month Day
# 1    41     190  7.4   67     5   1
# 2    36     118  8.0   72     5   2
# 3    12     149 12.6   74     5   3
# 4    18     313 11.5   62     5   4
```

```
# 7    23     299  8.6   65     5   7
# 8    19      99 13.8   59     5   8

# reading data
# read.table, read.csv for reading tabular data
# return data.frame
#
# readLines for reading lines of a text file
#
# source for reading R code files
# dget for reading in R code files
# load for reading in saved workspaces
# unserialize for reading single R objects in binary form
#
# read.table
#  file, header(flag), sep(column sep), colClasses(character vector)
#  nrows(number of rows), comment.char (comment char), skip (first
lines to skip)
#  stringsAsFactors (character variables coded as factors?)

# set comment.char=""
# use colClasses argument, read.table can run much faster

data <- read.table("week01/foo.txt")
data <- read.csv("week01/foo.txt")
data
#   nbrline amount amount2
# 1       1    100    1000
# 2       1    200    2000
attributes(data)

# dumping and dputing preserve metadata
y <- data.frame(a = 1, b = "a")
dput(y)
# structure(list(a = 1, b = structure(1L, .Label = "a", class =
"factor")), .Names = c("a",
# "b"), row.names = c(NA, -1L), class = "data.frame")
dput(y, file ="week01/y.R")

new.y <- dget("week01/y.R")
new.y
#     a b
#   1 1 a

x <- "foo"
y <- data.frame(a = 1, b="a")
dump(c("x", "y"), file="week01/data.R")
rm(x,y)
source("week01/data.R")
y
#   a b
# 1 1 a
x

R version 3.1.0 (2014-04-10) -- "Spring Dance"
```

```
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Platform: x86_64-apple-darwin10.8.0 (64-bit)

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'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

> library(datasets)
> data(airquality)
> airquality
Ozone Solar.R Wind Temp Month Day
1      41     190  7.4   67     5   1
2      36     118  8.0   72     5   2
3      12     149 12.6   74     5   3
4      18     313 11.5   62     5   4
5      NA      NA 14.3   56     5   5
6      28      NA 14.9   66     5   6
7      23     299  8.6   65     5   7
8      19      99 13.8   59     5   8
9       8      19 20.1   61     5   9
10     NA     194  8.6   69     5  10
11      7      NA  6.9   74     5  11
12     16     256  9.7   69     5  12
13     11     290  9.2   66     5  13
14     14     274 10.9   68     5  14
15     18      65 13.2   58     5  15
16     14     334 11.5   64     5  16
17     34     307 12.0   66     5  17
18      6      78 18.4   57     5  18
19     30     322 11.5   68     5  19
20     11      44  9.7   62     5  20
21      1       8  9.7   59     5  21
22     11     320 16.6   73     5  22
23      4      25  9.7   61     5  23
24     32      92 12.0   61     5  24
25     NA      66 16.6   57     5  25
26     NA     266 14.9   58     5  26
27     NA      NA  8.0   57     5  27
28     23      13 12.0   67     5  28
29     45     252 14.9   81     5  29
30    115     223  5.7   79     5  30
31     37     279  7.4   76     5  31
32     NA     286  8.6   78     6   1
33     NA     287  9.7   74     6   2
34     NA     242 16.1   67     6   3
35     NA     186  9.2   84     6   4
36     NA     220  8.6   85     6   5
```

37	NA	264	14.3	79	6	6
38	29	127	9.7	82	6	7
39	NA	273	6.9	87	6	8
40	71	291	13.8	90	6	9
41	39	323	11.5	87	6	10
42	NA	259	10.9	93	6	11
43	NA	250	9.2	92	6	12
44	23	148	8.0	82	6	13
45	NA	332	13.8	80	6	14
46	NA	322	11.5	79	6	15
47	21	191	14.9	77	6	16
48	37	284	20.7	72	6	17
49	20	37	9.2	65	6	18
50	12	120	11.5	73	6	19
51	13	137	10.3	76	6	20
52	NA	150	6.3	77	6	21
53	NA	59	1.7	76	6	22
54	NA	91	4.6	76	6	23
55	NA	250	6.3	76	6	24
56	NA	135	8.0	75	6	25
57	NA	127	8.0	78	6	26
58	NA	47	10.3	73	6	27
59	NA	98	11.5	80	6	28
60	NA	31	14.9	77	6	29
61	NA	138	8.0	83	6	30
62	135	269	4.1	84	7	1
63	49	248	9.2	85	7	2
64	32	236	9.2	81	7	3
65	NA	101	10.9	84	7	4
66	64	175	4.6	83	7	5
67	40	314	10.9	83	7	6
68	77	276	5.1	88	7	7
69	97	267	6.3	92	7	8
70	97	272	5.7	92	7	9
71	85	175	7.4	89	7	10
72	NA	139	8.6	82	7	11
73	10	264	14.3	73	7	12
74	27	175	14.9	81	7	13
75	NA	291	14.9	91	7	14
76	7	48	14.3	80	7	15
77	48	260	6.9	81	7	16
78	35	274	10.3	82	7	17
79	61	285	6.3	84	7	18
80	79	187	5.1	87	7	19
81	63	220	11.5	85	7	20
82	16	7	6.9	74	7	21
83	NA	258	9.7	81	7	22
84	NA	295	11.5	82	7	23
85	80	294	8.6	86	7	24
86	108	223	8.0	85	7	25
87	20	81	8.6	82	7	26
88	52	82	12.0	86	7	27
89	82	213	7.4	88	7	28
90	50	275	7.4	86	7	29
91	64	253	7.4	83	7	30

92	59	254	9.2	81	7	31
93	39	83	6.9	81	8	1
94	9	24	13.8	81	8	2
95	16	77	7.4	82	8	3
96	78	NA	6.9	86	8	4
97	35	NA	7.4	85	8	5
98	66	NA	4.6	87	8	6
99	122	255	4.0	89	8	7
100	89	229	10.3	90	8	8
101	110	207	8.0	90	8	9
102	NA	222	8.6	92	8	10
103	NA	137	11.5	86	8	11
104	44	192	11.5	86	8	12
105	28	273	11.5	82	8	13
106	65	157	9.7	80	8	14
107	NA	64	11.5	79	8	15
108	22	71	10.3	77	8	16
109	59	51	6.3	79	8	17
110	23	115	7.4	76	8	18
111	31	244	10.9	78	8	19
112	44	190	10.3	78	8	20
113	21	259	15.5	77	8	21
114	9	36	14.3	72	8	22
115	NA	255	12.6	75	8	23
116	45	212	9.7	79	8	24
117	168	238	3.4	81	8	25
118	73	215	8.0	86	8	26
119	NA	153	5.7	88	8	27
120	76	203	9.7	97	8	28
121	118	225	2.3	94	8	29
122	84	237	6.3	96	8	30
123	85	188	6.3	94	8	31
124	96	167	6.9	91	9	1
125	78	197	5.1	92	9	2
126	73	183	2.8	93	9	3
127	91	189	4.6	93	9	4
128	47	95	7.4	87	9	5
129	32	92	15.5	84	9	6
130	20	252	10.9	80	9	7
131	23	220	10.3	78	9	8
132	21	230	10.9	75	9	9
133	24	259	9.7	73	9	10
134	44	236	14.9	81	9	11
135	21	259	15.5	76	9	12
136	28	238	6.3	77	9	13
137	9	24	10.9	71	9	14
138	13	112	11.5	71	9	15
139	46	237	6.9	78	9	16
140	18	224	13.8	67	9	17
141	13	27	10.3	76	9	18
142	24	238	10.3	68	9	19
143	16	201	8.0	82	9	20
144	13	238	12.6	64	9	21
145	23	14	9.2	71	9	22
146	36	139	10.3	81	9	23

```
147     7      49 10.3   69     9  24
148    14      20 16.6   63     9  25
149    30     193  6.9   70     9  26
150    NA     145 13.2   77     9  27
151    14     191 14.3   75     9  28
152    18     131  8.0   76     9  29
153    20     223 11.5   68     9  30
> airquality[1:2,]
Ozone Solar.R Wind Temp Month Day
1    41     190  7.4   67     5   1
2    36     118  8.0   72     5   2
> cor(airquality)
Ozone Solar.R       Wind       Temp        Month
Ozone       1      NA         NA         NA           NA
Solar.R    NA       1         NA         NA           NA
Wind       NA      NA  1.0000000 -0.4579879 -0.178292579
Temp       NA      NA -0.4579879  1.0000000  0.420947252
Month      NA      NA -0.1782926  0.4209473  1.000000000
Day        NA      NA  0.0271809 -0.1305932 -0.007961763
Day
Ozone             NA
Solar.R           NA
Wind     0.027180903
Temp    -0.130593175
Month   -0.007961763
Day      1.000000000
> a <- vector("Integer", 3)
Error in vector("Integer", 3) :
  vector: cannot make a vector of mode 'Integer'.
> a <- vector('int', 3)
Error in vector("int", 3) : vector: cannot make a vector of mode
'int'.
> a <- vector()
> a
logical(0)
> a <- vector(mode="integer", 2)
> class(a)
[1] "integer"
> a.class
Error: object 'a.class' not found
> attributes(a)
NULL
> x <- 1
> print(x)
[1] 1
> x
[1] 1
> x
[1] 1
> x <- 1
> print(x)
[1] 1
> msg <- "hello"
> msg
[1] "hello"
```

```
> x <- 1:20
> x
 [1]  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19
[20] 20
> x <- c(1+0i, 2+4i)
> x
[1] 1+0i 2+4i
> class(x)
[1] "complex"
> x <- c("a", "b", "c")
> x <- c(T, F)
> x
[1]  TRUE FALSE
> x <- c(0.6, 0.6)
> x
[1] 0.6 0.6
> y <- c(1.7, "a")
> y
[1] "1.7" "a"
> class(y)
[1] "character"
> y <- c("a", TRUE)
> class(y)
[1] "character"
> y <- c(TRUE, 2)
> class(y)
[1] "numeric"
> x <- 0:6
> class(x)
[1] "integer"
> as.numeric(x)
[1] 0 1 2 3 4 5 6
> class(x)
[1] "integer"
> v <- as.numeric(x)
> class(v)
[1] "numeric"
> v <- as.logical(x)
> v
[1] FALSE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
> v <- as.character(x)
> v
[1] "0" "1" "2" "3" "4" "5" "6"
> x <- c("a", "b", "c")
> as.numeric(x)
[1] NA NA NA
Warning message:
  NAs introduced by coercion
> m <- matrix(nrow=2, ncol=3)
> m
[,1] [,2] [,3]
[1,]   NA   NA   NA
[2,]   NA   NA   NA
> dim(m)
[1] 2 3
```

```
> attributes(m)
$dim
[1] 2 3

> m <- matrix(1:6, nrow=2, ncol=3)
> m
[,1] [,2] [,3]
[1,]    1    3    5
[2,]    2    4    6
> m <- 1:10
> dim(m) <- c(2,5)
> m
[,1] [,2] [,3] [,4] [,5]
[1,]    1    3    5    7    9
[2,]    2    4    6    8   10
> stats(m)
Error: could not find function "stats"
> summary(m)
V1              V2              V3              V4
Min.   :1.00   Min.   :3.00   Min.   :5.00   Min.   :7.00
1st Qu.:1.25   1st Qu.:3.25   1st Qu.:5.25   1st Qu.:7.25
Median :1.50   Median :3.50   Median :5.50   Median :7.50
Mean   :1.50   Mean   :3.50   Mean   :5.50   Mean   :7.50
3rd Qu.:1.75   3rd Qu.:3.75   3rd Qu.:5.75   3rd Qu.:7.75
Max.   :2.00   Max.   :4.00   Max.   :6.00   Max.   :8.00
V5
Min.   : 9.00
1st Qu.: 9.25
Median : 9.50
Mean   : 9.50
3rd Qu.: 9.75
Max.   :10.00
> x <- 1:3
> y <- 10:12
>
  > cbind(x, y)
x  y
[1,] 1 10
[2,] 2 11
[3,] 3 12
> rbind(x, y)
[,1] [,2] [,3]
x    1    2    3
y   10   11   12
> x <- list(1, "a", TRUE, 1+4i)
> class(x)
[1] "list"
> x
[[1]]
[1] 1

[[2]]
[1] "a"

[[3]]
```

```
[1] TRUE

[[4]]
[1] 1+4i

> x <- factor("yes", "yes", "no", "yes", "no")
Error in if (ordered) "ordered" :
  argument is not interpretable as logical
> x
[[1]]
[1] 1

[[2]]
[1] "a"

[[3]]
[1] TRUE

[[4]]
[1] 1+4i

> x <- factor(c("yes", "yes", "no", "yes", "no"))
> x
[1] yes yes no  yes no
Levels: no yes
> table(x)
x
no yes
2   3
> unclass(x)
[1] 2 2 1 2 1
attr(,"levels")
[1] "no"  "yes"
> x <- factor(c("yes", "yes", "no", "yes", "no"), levels= c("yes",
"no"))
> x
[1] yes yes no  yes no
Levels: yes no
> table(x)
x
yes  no
3   2
> x <- c(1, 2, NA, 10, 3)
> is.na(x)
[1] FALSE FALSE  TRUE FALSE FALSE
> is.nan(x)
[1] FALSE FALSE FALSE FALSE FALSE
> x <- c(1, 2, NaN, Na, 4)
Error: object 'Na' not found
> x <- c(1, 2, NaN, NA, 4)
> x <- c(1, 2, NaN, NA, 4)
> is.na(x)
[1] FALSE FALSE  TRUE  TRUE FALSE
> is.nan(x)
[1] FALSE FALSE  TRUE FALSE FALSE
```

```
> x <- data.frame(foo=1:4, bar= c(T, T, F, F))
> x
foo   bar
1   1  TRUE
2   2  TRUE
3   3 FALSE
4   4 FALSE
> nrow(x)
[1] 4
> ncol(x)
[1] 2
> x <- 1:3
> x
[1] 1 2 3
> x <- 1:3
> names(x) <- c("foo", "bar", "norf")
> x
foo  bar norf
1    2    3
> x <- list(a =1, b=2, c=3)
> x
$a
[1] 1

$b
[1] 2

$c
[1] 3

> m <- matrix(1:4, nrow=2, ncol=2)
> dimnames(m)
NULL
> dimnames(m) <- list(c("a", "b"), c("c", "d"))
> m
c d
a 1 3
b 2 4
> x <- c("a", "b", "c", "c", "d", "a")
> x[1]
[1] "a"
> x[2]
[1] "b"
> x[1:4]
[1] "a" "b" "c" "c"
> x[x > "a"]
[1] "b" "c" "c" "d"
> u <-  x > "a"
> u
[1] FALSE  TRUE  TRUE  TRUE  TRUE FALSE
> x[u]
[1] "b" "c" "c" "d"
> x[1, 2]
Error in x[1, 2] : incorrect number of dimensions
> x[1, 2]
```

```
Error in x[1, 2] : incorrect number of dimensions
> x <- matrix(1:6, 2, 3)
> x[1, 2]
[1] 3
> x[2, 1]
[1] 2
> x[1, ]
[1] 1 3 5
> x[, 2]
[1] 3 4
> x[1, 2]
[1] 3
> class(x[1,2])
[1] "integer"
> class(x[1,2, drop = FALSE])
[1] "matrix"
> x <- matrix(1:6, 2, 3)
> x[1,]
[1] 1 3 5
> x[1, , drop = FALSE]
[,1] [,2] [,3]
[1,]    1    3    5
> x[1]
[1] 1
> x <- list(foo = 1:4, bar = 0.6)
> x[1]
$foo
[1] 1 2 3 4

> x[[1]]
[1] 1 2 3 4
> class(x[1])
[1] "list"
> class(x[[1]])
[1] "integer"
> x$bar
[1] 0.6
> x[["bar"]]
[1] 0.6
> x["bar"]
$bar
[1] 0.6

> x <- list(foo = 1:4, bar = 0.6, baz = "hello")
> x[c(1,3)]
$foo
[1] 1 2 3 4

$baz
[1] "hello"

> x <- list(foo = 1:4, bar = 0.6, baz = "hello")
> name <- "foo"
> x[[name]]
[1] 1 2 3 4
```

```
> x$name
NULL
> x <- list(a = list(10, 12, 14), b= c(3.4, 2.81))
> x <- list(a = list(10, 12, 14), b= c(3.4, 2.81))
> x[[c(1,3)]]
[1] 14
> x[[1]]
[[1]]
[1] 10

[[2]]
[1] 12

[[3]]
[1] 14

> x[[1]][[3]]
[1] 14
> x[[c(2,1)]]
[1] 3.4
> x$a
[[1]]
[1] 10

[[2]]
[1] 12

[[3]]
[1] 14

> x <- list(aardvark = 1:5)
> x$a
[1] 1 2 3 4 5
> x[["a"]]
NULL
> x[["a", exact="FALSE"]]
[1] 1 2 3 4 5
> source('~/.active-rstudio-document', echo=TRUE)
Error in source("~/.active-rstudio-document", echo = TRUE) :
  ~/.active-rstudio-document:27:8: unexpected numeric constant
26: x <- c("a", "b", "c")  # character
27: x <- c 9
^
  > x <- c(1, 2, NA, 4, NA, 5)
> bad <- is.na(x)
> bad
[1] FALSE FALSE  TRUE FALSE  TRUE FALSE
> x[!bad]
[1] 1 2 4 5
> good <- complete.cases(x, y)
Error in complete.cases(x, y) : not all arguments have the same length
> x <- c(1, 2, NA, 4, NA, 5)
> y <- c("a", "b", NA, "d", NA, "f")
> good <- complete.cases(x, y)
> good
```

```
[1]  TRUE  TRUE FALSE  TRUE FALSE  TRUE
> x[good]
[1] 1 2 4 5
> y[good]
[1] "a" "b" "d" "f"
> datasets(airquality)
Error: could not find function "datasets"
> library(datasets)
> datasets(airquality)
Error: could not find function "datasets"
> data(airquality)
> airquality[1:6,]
Ozone Solar.R Wind Temp Month Day
1    41     190  7.4   67     5   1
2    36     118  8.0   72     5   2
3    12     149 12.6   74     5   3
4    18     313 11.5   62     5   4
5    NA      NA 14.3   56     5   5
6    28      NA 14.9   66     5   6
> good <- complete.cases(airquality)
> airquality[good, ][1:6,]
Ozone Solar.R Wind Temp Month Day
1    41     190  7.4   67     5   1
2    36     118  8.0   72     5   2
3    12     149 12.6   74     5   3
4    18     313 11.5   62     5   4
7    23     299  8.6   65     5   7
8    19      99 13.8   59     5   8
> data <- read.table("foo.txt")
Error in file(file, "rt") : cannot open the connection
In addition: Warning message:
  In file(file, "rt") : cannot open file 'foo.txt': No such file or
directory
> data <- read.table("week01/foo.txt")
Warning message:
  In read.table("week01/foo.txt") :
  incomplete final line found by readTableHeader on 'week01/foo.txt'
> data <- read.table("week01/foo.txt")
> data
V1
1 nbrline,amount,amount2
2             1,100,1000
3             1,200,2000
> data <- read.csv("week01/foo.txt")
> data
nbrline amount amount2
1       1    100    1000
2       1    200    2000
> attributes(data)
$names
[1] "nbrline" "amount"  "amount2"

$class
[1] "data.frame"
```

```
$row.names
[1] 1 2

> y <- data.frame(a = 1, b = "a")
> dput(y)
structure(list(a = 1, b = structure(1L, .Label = "a", class =
"factor")), .Names = c("a",

"b"), row.names = c(NA, -1L), class = "data.frame")
> dput(y, file ="y.R")
> new.y <- dget("week01/y.R")
> new.y
a b
1 1 a
> x <- "foo"
> y <- data.frame(a = 1, b="a")
> dump(c("x", "y"), file="week01/data.R")
> rm(x,y)
> source("week01/data.R")
> y
#   a b
# 1 1 a
> x
# [1] "foo"

# interface to the outside world
#   file, gzfile, bzfile, url

# str(file)
# connections

con <- file("week01/foo.txt", "r")
data <- read.csv(con)
data

con <- gzfile("words.gz")
x <- readLines(con, 10)
g

con <- url("http://www.jhsph.edu", "r")
x <- readLines(con)
head(x)
```