Input and Output

Text

- A string of characters is said to be of mode character.
- Character strings are denoted by either double quotes " " or single quotes ‘’.
- Strings can be arranged into vectors and matrices just like numbers.
- We can paste string using `paste(???, sep)`.

```
x <- "Citroen SM"
y <- "Jaguar XK150"
z <- "Ford Falcon GT-HO"
(wish.list <- paste(x, y, z, sep=", "))
```

```
## [1] "Citroen SM, Jaguar XK150, Ford Falcon GT-HO"
```

- Special characters with the escape character .
- `\n` for newline, `\t` for tab, `\b` for backspace, `\"` for ", `\\` for `\`
- If a character string can be understood as a number, the `as.numeric(x)` is used.

```
as.numeric("10.1")
```

```
## [1] 10.1
```

- Use `as.character(x)` to coerce a number into a character string.

```
as.character(10.1)
```

```
## [1] "10.1"
```

Input from a file

- R provides a number of ways to read data from a file.
- `scan` function is the most flexible one.
- `scan` to read a vector of values from a file.
- `scan(file= "", what=0, n=-1, sep="", skip=0, quiet=FALSE)`
- all parameters are optional
- file gives the file to read from.
  - The default `" "` indicates read from the keyboard.
- what gives an example of the mode of data to be read.
  - use `0` for numeric value, use `" "` for character data.
- `n` gives the number of elements to read.
  - if `n = -1` then scan keeps reading until EOF.
- `sep` allows you to specify that is used to separate values such as “,”
- `skip` is the number of lines to skip before start reading.
- `quiet` controls whether or not scan reports how may values it has read.

Example : file input

```
# You need to change the path of the file accordingly.
data <- scan(file="data/data1.txt")
n <- length(data)
data.sort <- sort(data)
data.1qrt <- data.sort[ceiling(n/4)]
data.med <- data.sort[ceiling(n/2)]
```

```
data.3qrt <- data.sort[ceiling(3*n/4)]
cat("1st Quartile:", data.1qrt, "\n")
```

```
## 1st Quartile: 2
```

```
cat("Median:      ", data.med, "\n")
```

```
## Median:       4
```

```
cat("3rd Quartile:", data.3qrt, "\n")
```

```
## 3rd Quartile: 7
```

By using the built-in function quantile

```
quantile( scan("data/data1.txt"), (0:4)/4 )
```

```
##   0%  25%  50%  75% 100%
## 0.00 2.25 4.50 6.75 9.00
```

Input from the keyboard

- scan can be used to read from the keyboard if `file` is `""`.

```
scan(file="", what="")    # character input
scan(file="", what=0)    # numeric input
```

- `readline(prompt)` read a single line of text from the keyboard.
- `prompt` (default "") : takes the optional character input

```
your_name <- readline("Input your name : ")
```

Example : Root of quadratic

```
cat("find zeros of a2*x^2 +a1*x +a0 = 0\n")
a2 <- as.numeric(readline("a2= "))
a1 <- as.numeric(readline("a1= "))
a0 <- as.numeric(readline("a0= "))
discrim <- a1^2 - 4*a2*a0

if (discrim > 0) {
  roots <- (-a1 + c(1,-1) * sqrt(a1^2 - 4*a2*a0))/(2*a2)
} else if (discrim == 0) {
  roots <- -a1/(2*a2)
} else {
  roots <- c()
}

if (length(roots) == 0){
  cat("no root\n")
} else if (length(roots)==1){
  cat("single root at", roots, "\n")
} else{
  cat("roots at", roots[1], "and", roots[2], "\n")
}
```

Output to a file

- Generally use `write` or `write.table` for writing numeric.
- `cat` for writing text, or a combination of numeric and text.
- `write(x, file = "data", ncolumns = if(is.character(x)) 1 else 5, append = FALSE)`
- `x` is the vector to be written.
  - If `x` is a matrix then it is converted to a vector (column by column)
- `file` gives the file to write as a character string
  - default `"data"` writes to a file called data in the current working directory
  - to write to the screen use `file=""`
- `ncolumns` : the number of columns to write the data in.
- `append` indicates whether to append to or overwrite the file.
- `write` converts matrices to vectors
- Since R stores its matrices by column, you should transpose the matrix to `write` if you want the output to reflect the matrix structure.

```
( x <- matrix(1:24, nrow=4, ncol=6))
write(t(x), file = "out.txt", ncolumn=6)
```

cat for writing to a file

- `cat` is more flexible command.
- `cat(???, file="", sep="", append=FALSE)`
- `???` is a list of expressions (separated by commas) that are coerced into character strings, concatenated, and then written.
- `file` gives the file to write or append to as a character string.
  - the default `""` writes to the screen.
- `sep` is character string that is inserted between objects.
- `append` indicates whether to append to or overwrite the file.

dump

- `dump` creates a text representation of almost any object that can subsequently read by `source`.

```
x <- matrix(rep(1:5, 1:5), nrow=3, ncol=5)
dump("x", file="result.txt")
rm(x)
source("result.txt")
x
```

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

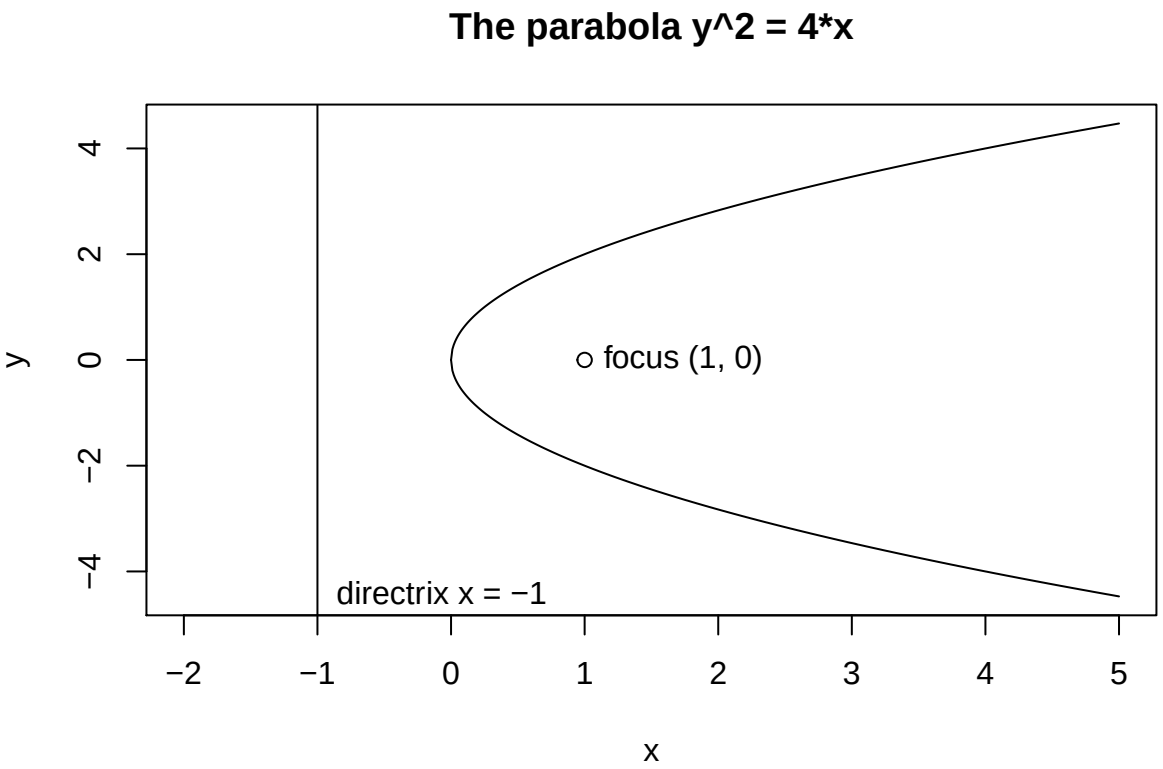
Plotting

- We have already seen `plot(x, y, type)`.

- To add points to the current plot, use `points(x, y)`.
- To add lines, use `lines(x, y)`.
- To add vertical or horizontal liens, use `abline(v=xpos)` or `abline(y=ypos)`.
- `points` and `lines` take optional input `col`, which determines color.
- `colors()` show the complete list of colors.
- To add text `labels[1]` at `(x[i], y[i])`, use `text(x, y, lables)`.
- `pos` is used to indicate the position. (See `help(text)`)
- `title(main)` for the title (`main` is a character string).

plotting a parabola $y^2 = 4x$

```
x <- seq(0, 5, by=0.01)
y.upper <- 2*sqrt(x)
y.lower <- -2*sqrt(x)
y.max <- max(y.upper)
y.min <- min(y.lower)
plot(c(-2,5), c(y.min, y.max), type="n", xlab="x", ylab="y")
lines(x, y.upper)
lines(x, y.lower)
abline(v=-1)
points(1,0)
text(1, 0, "focus (1, 0)", pos=4)
text(-1, y.min, "directrix x = -1", pos=4)
title("The parabola y^2 = 4*x")
```



more than one plots

- `windows()` open additional graphics devices.
- `par(mfrow = c(nr, nc))` or `par(mfcol = c(nr, nc))` creates a grid of plots.

- `mfrow = c(nr, nc))` : with `nr` rows and `nc` columns, filled row by row.
- `mfcol = c(nr, nc))` : filled column by column.

```
par(mfrow=c(2,2))
curve(x*sin(x), from=0, to=100, n=1001)
curve(x*sin(x), from=0, to=10, n=1001)
curve(x*sin(x), from=0, to=1, n=1001)
curve(x*sin(x), from=0, to=0.1, n=1001)
```