Untitled

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2015-10-01

Scope

In this session we will explore basic manipulations of variables.

- Assigning a value to a variable
- Basic operations on numbers

Slide With Code

Convention:

- Gray boxes: commands to type in RStudio **Console** (bottom-left panel).
- White boxes: the result you should obtain.

Example: create a variable named ***a***, assign the value ***27*** to this variable, and ***print*** the result.

```r
a <- 27
print(a)
```

```
## [1] 27
```

Vectors of values

The simplest data structure in R is a vector. In the previous example, the variable ***a*** was actually a vector with a single value.

Example: create a variable named ***three.numbers***, and initialize it with a vector with values ***27***, ***12*** and ***3000***.

Tips: - variable names can comprize several parts, separated by dots. - the function ***c()*** combines several values into a vector

```
three.numbers <- c(27,12,3000)
print(three.numbers)
```

```
## [1]   27   12 3000
```

Series

The simple way to create a series of numbers. The column operator permits to generate all integer values between two limits.

```r
x <- 0:14
print(x)
```

```
##  [1]  0  1  2  3  4  5  6  7  8  9 10 11 12 13 14
```

Computing with vectors

R handles vectors in a very convenient way. An operation on a vector applies to all its elements.

```
x <- 1:10 # Define a series from 1 to 10
print(x)
```

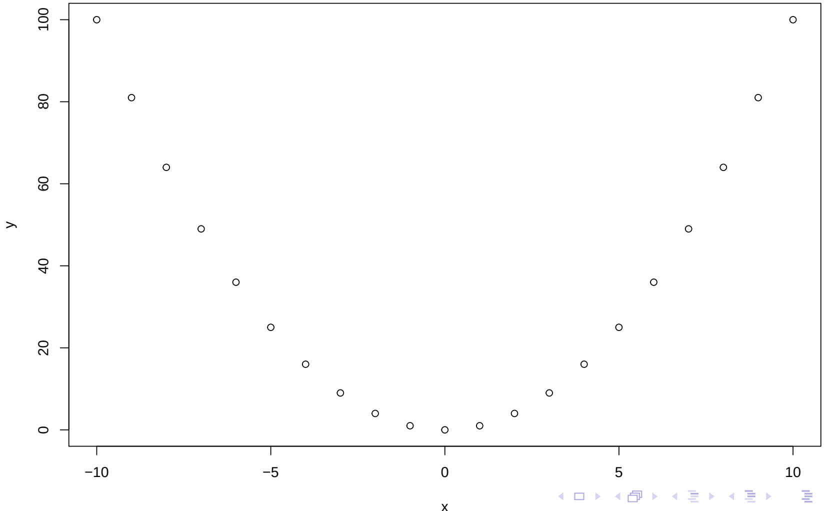
```
##  [1]  1  2  3  4  5  6  7  8  9 10
```

```
y <- x^2 # Compute the square of each number
print(y)
```

```
##  [1]   1   4   9  16  25  36  49  64  81 100
```

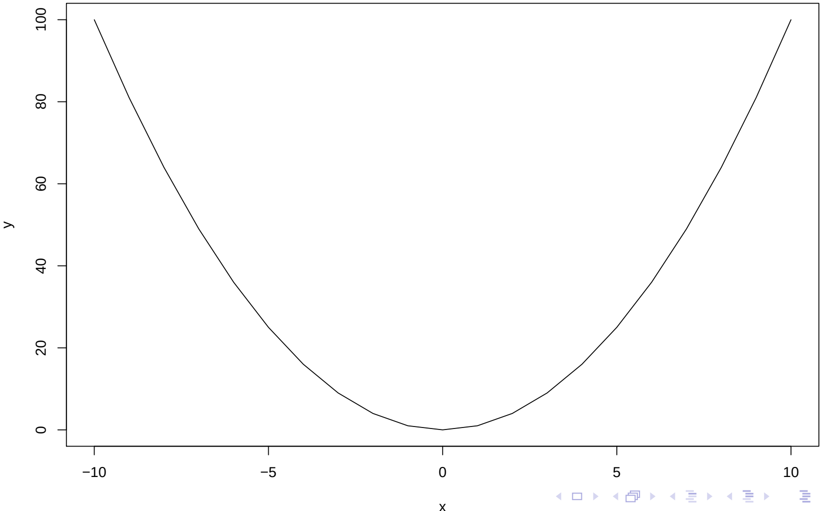
Scatter plot

```r
x <- -10:10
y <- x^2
plot(x,y)
```



Line plot

```r
x <- -10:10
y <- x^2
plot(x,y, type="l")
```



Variables can also contain strings

```r
# The # symbol allows to insert comments in R code

# Define  a vector named "whoami", and
# containing two names
whoami <- c("Denis", "Siméon")
print(whoami) # Comment at the end of a line
```

```
## [1] "Denis"  "Siméon"
```

String concatenation

```r
# Define  a vector named "names", and
# containing two names
whoami <- c("Denis", "Siméon")

# Paste the values of a vector of string
print(paste(sep=" ", whoami[1], whoami[2]))
```

```
## [1] "Denis Siméon"
```

Carl’s preferred distribution

The function **dpois()** computes the Poisson **density**, i.e. the probability to observe **exactly** x successes in a series of independent trials with equal probability.

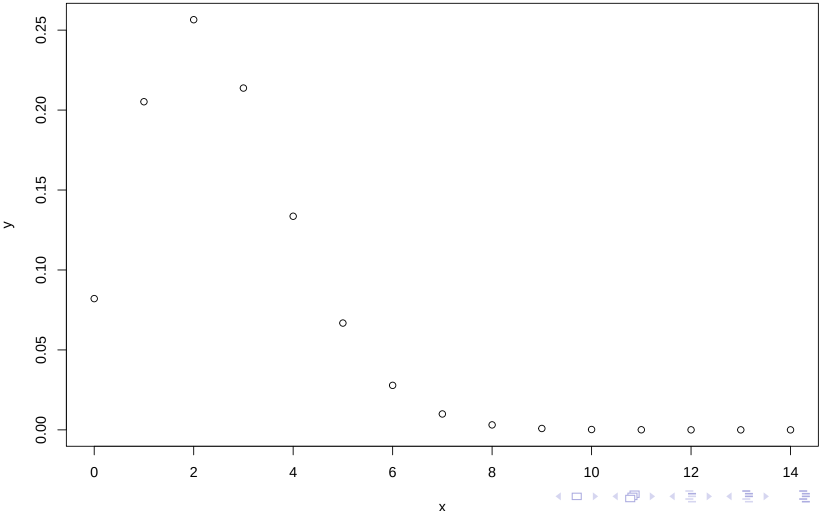
The Poisson distribution is defined by a single parameter: the expected number of successes λ (read “lambda”).

$$P(X = x) = \frac{e^{-\lambda}\lambda^{x}}{x!}$$

```r
x <- 0:14    # Define the X values from 0 to 14
y <- dpois(x, lambda = 2.5) # Poisson density
print(y) # Check the result
```

Plotting the Poisson distribution

```
x <- 0:14    # Define the X values from 0 to 14
y <- dpois(x, lambda = 2.5) # Poisson density
plot(x,y) # Check the result
```



Getting help for R functions

Need help? Type **`help()`**.

```r
help(plot)
```

A question? Type `?`

```r
?plot
```

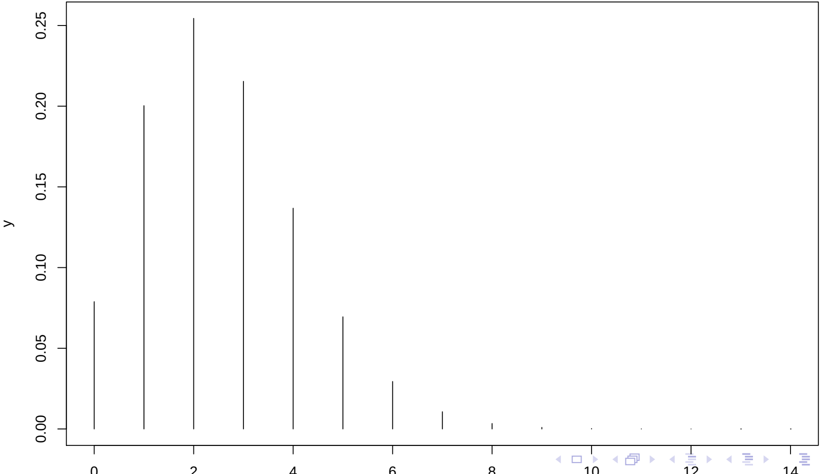
Result: R displays the help message for the function `dpois()`.

Exercise: improve Poisson density plot

1. Do not (yet) look the next slide.
2. Read the help page for the `dpois()`function.
3. draw a plot that provides a didactic illustration of the Poisson density.

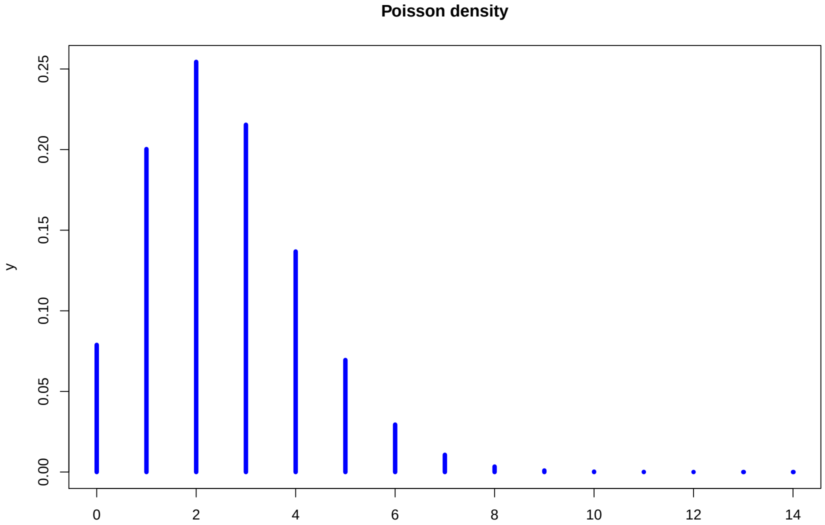
Improve the plot: type = histogram

```
x <- 0:14
lambda <- 2.54
y <- dpois(x, lambda)
plot(x,y, type="h")
```



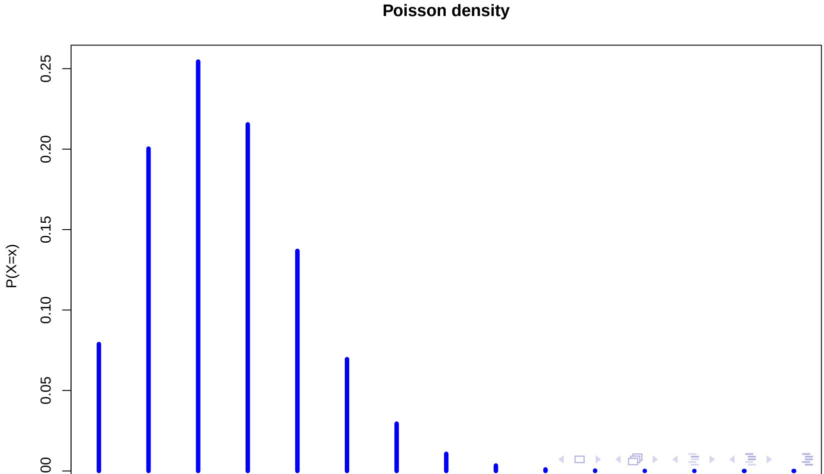
Improve the plot: Add a title

```
plot(x,y, type="h", lwd=5, col="blue",
     main="Poisson density")
```



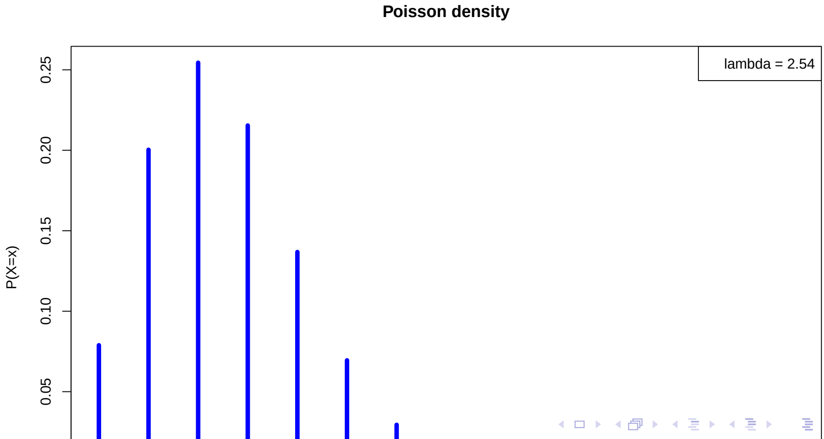
Improve the plot: define axis labels

```
plot(x,y, type="h", lwd=5, col="blue",
     main="Poisson density",
     xlab="x = number of successes",
     ylab="P(X=x)")
```



Improve the plot: add a legend

```
plot(x,y, type="h", lwd=5, col="blue",
     main="Poisson density",
     xlab="x = number of successes",
     ylab="P(X=x)")
legend("topright", paste("lambda =", lambda))
```



Poisson: a family of curves

Exercice: explore the properties of the Poisson density function, by changing the rang of x values, and the λ parameter.