Introduction to R Software

Introduction to Programming with Examples

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Steps to write a programme

- A programme is a set of instructions or commands which are written in a sequence of operations i.e., what comes first and what comes after that.

- The objective of a programme is to obtain a defined outcome based on input variables.

- The computer is instructed to perform the defined task.

Steps to write a programme

- Computer is an obedient worker but it has its own language.

- We do not understand computer's language and computer does not understand our language.

- The software help us and works like an interpreter between us and computer.

Steps to write a programme

- We say something in software's language and software informs it to computer.

- Computer does the task and informs back to software.

- The software translates it to our language and informs us.

Steps to write a programme

- Programme in R is written as a function using `function`.
- Write down the objective, i.e., what we want to obtain as an outcome.
- Translate it in the language of R.
- Identify the input and output variables.
- Identify the nature of input and output variables, i.e., numeric, string, factor, matrix etc.

Steps to write a

Steps to write a programme

Tips:

- **Loops usually slower the speed of programmes, so better is to use vectors and matrices.**

- **Use # symbol to write comment to understand the syntax.**

- **Use the variable names which are easy to understand.**

- **Don’t forget to initialize the variables.**

Example 1

Suppose we want to compute $\dfrac{\sum_{i=1}^{n} x_i^2}{\sum_{i=1}^{n} y_i^2}$ and $\sum_{i=1}^{n} \left(\dfrac{x_i}{y_i} \right)^2$

Data $x_1, x_2, \ldots, x_n$ $y_1, y_2, \ldots, y_n$

x, y: Two data vectors

Example 1

Input variables : `x, y, n` **(if** `x` **and** `y` **have different number of observations, choose different numbers, say** `n1` **and** `n2`**)**

Output variables: `g, h,` $g = \dfrac{\sum_{i=1}^{n} x_i^2}{\sum_{i=1}^{n} y_i^2}$ and $h = \sum_{i=1}^{n} \left(\dfrac{x_i}{y_i} \right)^2$

We need summation, so use `sum` **function or alternatively compute it through vectors.**

Example 1

```
# Remove all data
rm(list = ls())

# Define input data vectors, for example
x = c(10,20,30)
y = c(1,2,3)

++++++START OF FUNCTION++++++++
example1 <- function(x,y)

# Start of function body
{
# First give all other input variables

# Computation of number of observations
n <- length(x)
```

CONTD..

Example 1

CONTD…

```
 #Initialize the values to store squared values
x1 <- 0
y1 <- 0
z1 <- 0

#Start of loop
for (i in 1:n)
{
# Define x1, y1 and z1 to store their squares
  x1[i] <- x[i]^2
  y1[i] <- y[i]^2
  z1[i] <- (x[i]/y[i])^2
#End of loop
  }
```

CONTD…

Example 1

CONTD…

```
# Obtain the sum of squared quantities
sum_square_x <- sum(x1)
sum_square_y <- sum(y1)
sum_square_z <- sum(z1)

# Computation of g and h
g <- sum_square_x/sum_square_y
h <- sum_square_z

# Format the output
cat("The value of g and h are", g, "and", h,
"\n", )
}
++++++END OF FUNCTION++++++++
```

Example 1: At a glance

```
example1 <- function(x,y)
{
  n <- length(x)
  x1 <- 0
  y1 <- 0
  z1 <- 0
  for (i in 1:n)
  {
    x1[i] <- x[i]^2
    y1[i] <- y[i]^2
    z1[i] <- (x[i]/y[i])^2
  }
  sum_square_x <- sum(x1)
  sum_square_y <- sum(y1)
  sum_square_z <- sum(z1)
  g <- sum_square_x/sum_square_y
  h <- sum_square_z
  cat("The value of g and h are", g, "and", h,
        "respectively", "\n")
}
```

Example 1

R Console

```
> example1 <- function(x,y)
+   # Start of function body
+ {
+   # First give all other input variables
+   # Computation of number of observations
+   n <- length(x)
+   #Initialize the values to store squared values
+   x1 <- 0
+   y1 <- 0
+   z1 <- 0
+   #Start of loop
+   for (i in 1:n)
+   {
+     # Define x1, y1 and z1 to store their squares
+     x1[i] <- x[i]^2
+     y1[i] <- y[i]^2
+     z1[i] <- (x[i]/y[i])^2
+     #End of loop
+   }
+   # Obtain the sum of squared quantities
+   sum_square_x <- sum(x1)
+   sum_square_y <- sum(y1)
+   sum_square_z <- sum(z1)
+   # Computation of g and h
+   g <- sum_square_x/sum_square_y
+   h <- sum_square_z
+   # Format the output
+   cat("The value of g and h are", g, "and", h, "respectively", "\n")
+   # End of function
+ }
```

Example 1

R Console

```
> example1
function(x,y)
  # Start of function body
{
  # First give all other input variables
  # Computation of number of observations
  n <- length(x)
  #Initialize the values to store squared values
  x1 <- 0
  y1 <- 0
  z1 <- 0
  #Start of loop
  for (i in 1:n)
  {
    # Define x1, y1 and z1 to store their squares
    x1[i] <- x[i]^2
    y1[i] <- y[i]^2
    z1[i] <- (x[i]/y[i])^2
    #End of loop
  }
  # Obtain the sum of squared quantities
  sum_square_x <- sum(x1)
  sum_square_y <- sum(y1)
  sum_square_z <- sum(z1)
  # Computation of g and h
  g <- sum_square_x/sum_square_y
  h <- sum_square_z
  # Format the output
  cat("The value of g and h are", g, "and", h, "respectively", "\n")
  # End of function
}
```

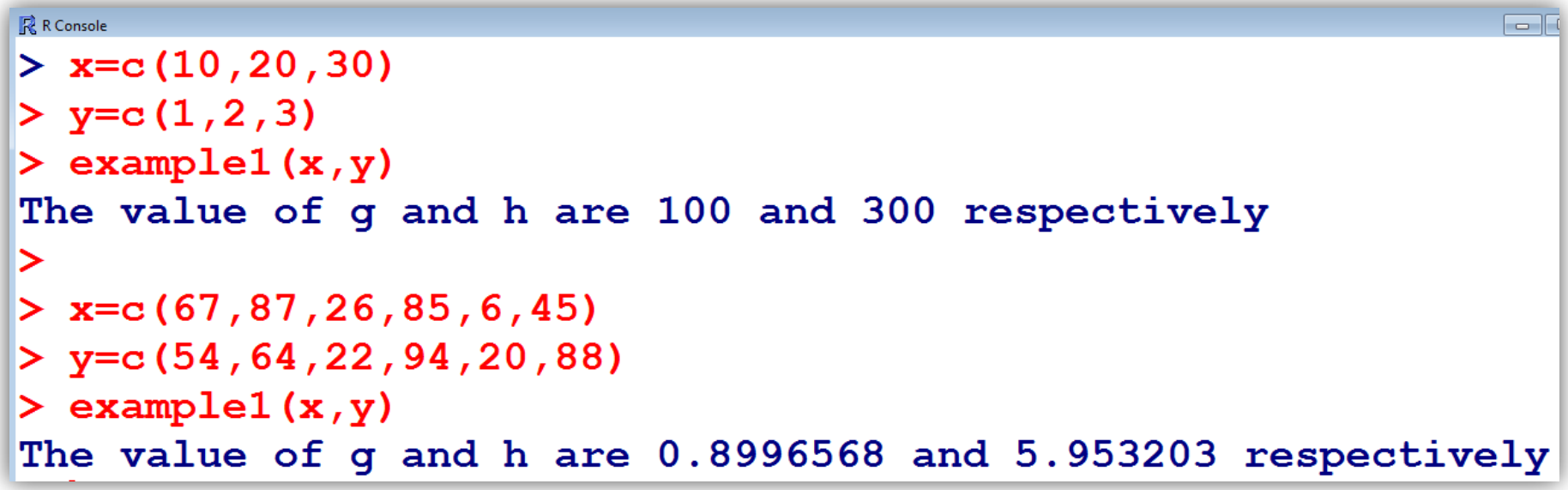
Example 1

```
> x=c(10,20,30)
> y=c(1,2,3)
> example1(x,y)
The value of g and h are 100 and 300 respectively
```

```
> x=c(67,87,26,85,6,45)
> y=c(54,64,22,94,20,88)
> example1(x,y)
The value of g and h are 0.8996568 and 5.953203
respectively
```

Just by changing the values of `x` and `y`, one can get required different outcomes.

Example 1


R Console
> x=c(10,20,30)
> y=c(1,2,3)
> example1(x,y)
The value of g and h are 100 and 300 respectively
>
> x=c(67,87,26,85,6,45)
> y=c(54,64,22,94,20,88)
> example1(x,y)
The value of g and h are 0.8996568 and 5.953203 respectively