

Assignments – Making Functions II

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0) Create a non-recursive and a recursive function that generates the factorial of x . Measure the runtime of both algorithms using the `proc.time` function. Create a graph showing the runtime of both algorithms.

1) The Fibonacci sequence known in literature since 1202 is one of the most often used examples of a recursive algorithm. It has a relation to the golden ratio and is therefore often used in computer science. Create a recursive function that generates X numbers of the Fibonacci sequence. The sequence is defined as follows:

$$F_{(n)} = F_{(n-1)} + F_{(n-2)}$$

with seed values:

$$F_{(0)} = 0, F_{(1)} = 1$$

2) Write your own `Lapply` function that works on an input vector, using a function called `FUN`.

3) If we take two functions we can do something called function composition. Create a function that takes as input:

1. A vector of numeric items
2. A integer based selector
3. Function `F`
4. Function `G`

The selector is an integer specifying to either `Lapply` only `F`, only `G` or the combination `FG`, or `GF`.

The selector can thus take 4 values: 1, 2, 3, 4. make sure to use input checking on the selector and throw an error when the value supplied is out-of-bounds. Use the following simple functions, for `F` and `G` to test your solution:

```
F <- function(x) { return(x+1); }  
G <- function(x) { return(x/2); }
```

4) Load the supplied dataset into `R`, and create a linear model to investigate the effects of the different predictor variables: Sex, Age and Treatment on the survival outcome of the disease.

First study the effects of the different predictors without compensating for the other predictors; then build the more complex models involving multiple predictors at the same time, at every step, use the `anova` function on the linear model to obtain probability values. Make sure you are able to answer questions like:

What effects are significant?

Does the order of the different predictor variables have an influence on their significance?

Is the treatment effective to cure the disease?

Has this hypothetical clinical trial been setup correctly?

Additional Assignments:

*Your candle fades, as you walk into darkness.
Suddenly you realize you are on your own.*

AA1) The greatest common divisor (GCD) is another example of a function that can be expressed as a recursive algorithm. It is used to reduce fractions to be in the lowest term, and can be used to find co-primes. Can you implement the GCD as a recursive function?

AA2) Create an algorithm that checks if a number is a prime number. Then use this function as input for another function that generates a sequence of all prime numbers under a 100. Does there exist a recursive algorithm that is able to generate only prime numbers?