Problem Set 02: Functions

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IMPORTANT:

- Create your answer in Rstudio. Run and test your program before submitting it.
- The task is to write one R script containing three functions.
- Hand in your solution to the compulsory exerciss as **one file** with the name `assignment02.R`
- If the name is incorrect, you get an error message from gradescope.
- Do not destroy or overwrite any variables or functions in your program.

1 Compulsory Exercises

Exercise 1 (Functions)**.** The function `badFn` does not work. Fix it.

Exercise 2 (Black-Scholes formula)**.** The famous Black-Scholes formula for option pricing takes five parameters: today's stock price S, the strike price K, the duration t, the interest rate r and the volatility σ. The price of a call option is then:

$$C = SN(d_1) - Ke^{-rt}N(d_2) \tag{1}$$

with $d_1 = \frac{\ln(S/K)+(r+\frac{1}{2}\sigma^2)t}{\sigma\sqrt{t}}$ and $d_2 = d_1 - \sigma\sqrt{t}$. The symbol $N(\cdot)$ denotes the c.d.f. of the standard normal distribution.

(a) Find the R function that calculates the c.d.f. of the standard normal distribution.

(b) Write a function `blackScholesCall` that calculates the price of a call option, given S, K, t, r and σ. Choose sensible names for the variables. Follow the standard structure for user-defined functions.

Hint: Test your function before submitting, see section "Solutions" for a test case.

Exercise 3 (Dcinterest)**.** Write a function `dcinterest`, that calculates the payoff of 1 dollar with annually discretely compounded interest. (This is the way a bank calculates interest on a savings account.) The function should take the following inputs (just like `ccinterest` from class): `r` = the interest rate as fractions of one (i.e. 0.05 means 5%) and `t` = time in years.

Note: At this point, assume that the duration in years to be an integer.

2 Solutions

Exercise 2. Test your function with these values:
$S = 100, K = 90, t = 1, r = 0.02, \sigma = 0.2$. The option price should be 14.8065.