VG101 — Introduction to Computer and Programming

Lab 2

Manuel — UM-JI (Fall 2016)

Goals of the lab

- Write clear algorithms
- Write MATLAB functions
- Use control statements in MATLAB

Ex. 1 — *Algorithm, function, conditional statements, and loops*

Given a continuous function f over an interval $[a, b]$ such that $\text{sign}(f(a)) \neq \text{sign}(f(b))$ find $r \in [a; b]$ such that $f(r) = 0$. The bisection method consists in dividing the interval $[a; b]$ into two sub-intervals $[a; c]$ and $[c; b]$ of equal size. Then either $f(a)$ and $f(c)$ or $f(c)$ and $f(b)$ will have different signs. In case $c = r$ we stop and return c, otherwise the process is repeated over the interval where the sign changes. The process of narrowing down the interval will only end when the error is smaller than a bound specified by the user.

1. Write a clear algorithm describing the bisection method
2. Implement the previous algorithm using a MATLAB function

Note: the degree of accuracy should be at least 0.001 (strictly positive and less than 0.001).

Ex. 2 — *Input and output*

Pascal's triangle is a triangular array composed of the binomial coefficients. Write a MATLAB function taking as input an integer n and which outputs n lines of Pascal's triangle in a text file. For instance in the case $n = 6$ the file should contain the following:

```
          1
        1   1
      1   2   1
    1   3   3   1
  1   4   6   4   1
1   5   10  10  1   5
```

Hint: either generate it using the fact that each number in the triangle is the sum of the two numbers directly above it or using the functions `pascal` `diag`, *and* `rot90`.

Ex. 3 — *Basics on functions*

Given a date Zeller's Congruence formula allows to determine the corresponding day of the week. The formula is as follows:

$$day = 1 + \left(d + \left\lfloor \frac{13m - 1}{5} \right\rfloor + y + \left\lfloor \frac{y}{4} \right\rfloor + \left\lfloor \frac{c}{4} \right\rfloor - 2c \right) \mod 7$$

where d is the day of the month (1–31), m the number of the month (from March=1 to February=12), y the year of the century (14 for 2014) and c the century minus one (20 for 2014); the value day is an integer between 1 and 7, with 1 representing Sunday. Assign January and February to previous year.
Write a MATLAB function which takes as input a date in the format [d m cy] and returns the corresponding day of the week (e.g. on the input [19 1 2012] the function should return Thursday).