ISC3, Fall 2022 (A22)
Computer works report TP 3, 03/10/2022

Wenlong CHEN

October 9, 2022

Exercise 1

Let $(x, y, z) \to F(x, y, z)$ be the mapping defined by

$$F(x,y,z) = \begin{bmatrix} (x-2)^2 - 1 \\ (y-z-3)^2 \\ (z+1)^2 - 1 \end{bmatrix}$$

Write a Scilab function Fout=F(xvec) that implements the mapping **F**, and a Scilab function Jout=FJac(xvec) that computes the Jacobian matrix of **F**.
Solution :
Sur la base de la définition de la matrice de Jacobi et de la fonction F, nous pouvons écrire la matrice de Jacobi de la fonction F

$$\begin{bmatrix} 2*(x-2) & 0 & 0 \\ 0 & 2*(y-z-3) & -2*(y-z-3) \\ 0 & 0 & 2*(z+1) \end{bmatrix}$$

Code pour cette question :

```
function Fout = F(xvec)
    Fout = zeros(1,3)
    Fout(1) = (xvec(1) - 2)^2 - 1
    Fout(2) = (xvec(2) - xvec(3) - 3)^2
    Fout(3) = (xvec(3) + 1)^2 - 1
endfunction

function Jout = FJac(xvec)
    Jout = zeros(3,3)
    Jout(1,1) = 2 * (xvec(1) - 2)
```

```
    Jout(2,2) = 2 * (xvec(2) - xvec(3) - 3)
    Jout(2,3) = -2 * (xvec(2) - xvec(3) - 3)
    Jout(3,3) = 2 * (xvec(3) + 1)
endfunction
```

Exercise 2

Implement the Newton method that numerically solve $F(x) = 0$. Use $x_0 = (0, 0, 0)$ as initial guess.
Solution :
Pour une erreur de 10^{-5}, seules onze itérations sont utilisées pour obtenir $x = (1, 3, 0)$.
Code pour cette question :

```
function [x,k]=Newton(x0,Fout,Jout,err) // k est le Nombre d'itérations
    k=1;x=x0;
    while abs(norm(F(x))) >err
        x = x+(-Jout(x)\Fout(x)')
        k=k+1
    end
endfunction

[x,k] = Newton(zeros(3,1),F,FJac,10^(-5))
```

Exercise 3

Consider an articulated arm made of two rods of respective length 4 and 3. The articulated arm is fixed at the origin $O(0, 0)$. The midpoint A that binds the two rods has coordinates $A(x, y)$. The free endpoint is denoted by B.
(a) Find (x, y) such that B = $(3, 3)$.