Taller sistemas de ecuaciones

Punto 1

A. En el sistema de ecuaciones que nos presentan se puede evidenciar que la matriz no es diagonalmente dominante.

$$\begin{pmatrix} 1 & -8 & -2 \\ 1 & 1 & 5 \\ 3 & -1 & 1 \end{pmatrix}$$

Se reorganizo de tal manera que cumpliera con la condición para lo cual se reorganizaron todas las filas quedando de la siguiente manera.

$$\begin{pmatrix} 3 & -1 & 1 \\ 1 & -8 & -2 \\ 1 & 1 & 5 \end{pmatrix}$$

```
In [6]: runfile('C:/Users/david/OneDrive/Documentos/taller 2 analisis numerico/punto
1A.py', wdir='C:/Users/david/OneDrive/Documentos/taller 2 analisis numerico')
Matriz original:
no es diagonal dominante
Matriz intercambiando filas:
es diagonal dominante
```

B. La matriz de transición encontrada a través del método de Jacobi es la siguiente:

```
[[ 0.          0.33333333 -0.33333333]
 [ 0.125      0.         -0.25      ]
 [-0.2       -0.2         0.        ]]
```

La convergencia del método se verificó a través a través de 3 matrices las cuales son: la matriz diagonal, la matriz diagonal superior y la matriz diagonal inferior con lo cual se puede concluir que el método de Jacobi si converge.

C. Realizando la implementación de los métodos de Jacobi y Gauss-Seidel, se ha hecho la comparación de ambos métodos haciendo 50 iteraciones en cada uno y se ha podido llegar a la conclusión de que el método de Gauss-Seidel converge más rápido que el método de Jacobi.

Jacobi

```
[-1.24489796 -0.57142857  1.16326531]
[-1.24489796 -0.57142857  1.16326531]
[-1.24489796 -0.57142857  1.16326531]
[-1.24489796 -0.57142857  1.16326531]
[-1.24489796 -0.57142857  1.16326531]
[-1.24489796 -0.57142857  1.16326531]
[-1.24489796 -0.57142857  1.16326531]
[-1.24489796 -0.57142857  1.16326531]
[-1.24489796 -0.57142857  1.16326531]
[-1.24489796 -0.57142857  1.16326531]
[-1.24489796 -0.57142857  1.16326531]
[-1.24489796 -0.57142857  1.16326531]
[-1.24489796 -0.57142857  1.16326531]
[-1.24489796 -0.57142857  1.16326531]
solucion: [-1.24489796 -0.57142857  1.16326531]
iteraciones: 50
```

Gauss-Seidel

```
[-1.24489796 -0.57142857  1.16326531]
[-1.24489796 -0.57142857  1.16326531]
[-1.24489796 -0.57142857  1.16326531]
[-1.24489796 -0.57142857  1.16326531]
[-1.24489796 -0.57142857  1.16326531]
[-1.24489796 -0.57142857  1.16326531]
[-1.24489796 -0.57142857  1.16326531]
[-1.24489796 -0.57142857  1.16326531]
[-1.24489796 -0.57142857  1.16326531]
[-1.24489796 -0.57142857  1.16326531]
[-1.24489796 -0.57142857  1.16326531]
[-1.24489796 -0.57142857  1.16326531]
[-1.24489796 -0.57142857  1.16326531]
[-1.24489796 -0.57142857  1.16326531]
[-1.24489796 -0.57142857  1.16326531]
solucion: [-1.24489796 -0.57142857  1.16326531]
iteraciones: 50
```

D.

Omega 1.01

```
Iteración:22
[[ 1.          0.35714286 -0.04081633]
 [ 0.34693878  1.          1.14285714]
 [ 0.34693878 -0.01020408  1.        ]]
[ 0.34693878 -0.35714286 -0.39795918]
Error: 1.66162967e-15

Iteración:23
[[ 1.          0.35714286 -0.04081633]
 [ 0.34693878  1.          1.14285714]
 [ 0.34693878 -0.01020408  1.        ]]
[ 0.34693878 -0.35714286 -0.39795918]
Error: 5.55111512e-16

[ 0.34693878 -0.35714286 -0.39795918]
```

Omega 1.06

```
Iteración:17
[[ 1.          0.35714286 -0.04081633]
 [ 0.34693878  1.          1.14285714]
 [ 0.34693878 -0.01020408  1.        ]]
[ 0.34693878 -0.35714286 -0.39795918]
Error: 3.84592537e-15

Iteración:18
[[ 1.          0.35714286 -0.04081633]
 [ 0.34693878  1.          1.14285714]
 [ 0.34693878 -0.01020408  1.        ]]
[ 0.34693878 -0.35714286 -0.39795918]
Error: 4.4408921e-16

[ 0.34693878 -0.35714286 -0.39795918]
```

Omega 1.15

```
Iteración:24
[[ 1.          0.35714286 -0.04081633]
 [ 0.34693878  1.          1.14285714]
 [ 0.34693878 -0.01020408  1.        ]]
[ 0.34693878 -0.35714286 -0.39795918]
Error: 1.98602732e-15

Iteración:25
[[ 1.          0.35714286 -0.04081633]
 [ 0.34693878  1.          1.14285714]
 [ 0.34693878 -0.01020408  1.        ]]
[ 0.34693878 -0.35714286 -0.39795918]
Error: 5.43895982e-16

[ 0.34693878 -0.35714286 -0.39795918]
```

Omega 1.23

```
Iteración:31
[[ 1.          0.35714286 -0.04081633]
 [ 0.34693878  1.          1.14285714]
 [ 0.34693878 -0.01020408  1.        ]]
[ 0.34693878 -0.35714286 -0.39795918]
Error: 1.04738231e-15

Iteración:32
[[ 1.          0.35714286 -0.04081633]
 [ 0.34693878  1.          1.14285714]
 [ 0.34693878 -0.01020408  1.        ]]
[ 0.34693878 -0.35714286 -0.39795918]
Error: 4.4408921e-16

[ 0.34693878 -0.35714286 -0.39795918]
```

Omega 1.3

```
Iteración:38
[[ 1.          0.35714286 -0.04081633]
 [ 0.34693878  1.          1.14285714]
 [ 0.34693878 -0.01020408  1.        ]]
[ 0.34693878 -0.35714286 -0.39795918]
Error: 2.03507242e-15

Iteración:39
[[ 1.          0.35714286 -0.04081633]
 [ 0.34693878  1.          1.14285714]
 [ 0.34693878 -0.01020408  1.        ]]
[ 0.34693878 -0.35714286 -0.39795918]
Error: 9.48574968e-16

[ 0.34693878 -0.35714286 -0.39795918]
```

Omega 1.37

```
Iteración:47
[[ 1.          0.35714286 -0.04081633]
 [ 0.34693878  1.          1.14285714]
 [ 0.34693878 -0.01020408  1.        ]]
[ 0.34693878 -0.35714286 -0.39795918]
Error: 1.04738231e-15

Iteración:48
[[ 1.          0.35714286 -0.04081633]
 [ 0.34693878  1.          1.14285714]
 [ 0.34693878 -0.01020408  1.        ]]
[ 0.34693878 -0.35714286 -0.39795918]
Error:          0

[ 0.34693878 -0.35714286 -0.39795918]
```

Omega 1.44

```
Iteración:49
[[ 1.          0.35714286 -0.04081633]
 [ 0.34693878  1.          1.14285714]
 [ 0.34693878 -0.01020408  1.        ]]
[ 0.34693878 -0.35714286 -0.39795918]
Error: 2.84293152e-13

Iteración:50
[[ 1.          0.35714286 -0.04081633]
 [ 0.34693878  1.          1.14285714]
 [ 0.34693878 -0.01020408  1.        ]]
[ 0.34693878 -0.35714286 -0.39795918]
Error: 1.55510505e-13

[ 0.34693878 -0.35714286 -0.39795918]
```

Omega 1.5

```
Iteración:49
[[ 1.          0.35714286 -0.04081633]
 [ 0.34693878  1.          1.14285714]
 [ 0.34693878 -0.01020408  1.        ]]
[ 0.34693878 -0.35714286 -0.39795918]
Error: 5.59454798e-11

Iteración:50
[[ 1.          0.35714286 -0.04081633]
 [ 0.34693878  1.          1.14285714]
 [ 0.34693878 -0.01020408  1.        ]]
[ 0.34693878 -0.35714286 -0.39795918]
Error: 3.38355438e-11

[ 0.34693878 -0.35714286 -0.39795918]
```

Omega 1.58

```
Iteración:49
[[ 1.          0.35714286 -0.04081633]
 [ 0.34693877  1.          1.14285714]
 [ 0.34693877 -0.01020408  1.        ]]
[ 0.34693877 -0.35714285 -0.39795918]
Error: 2.80993606e-08

Iteración:50
[[ 1.          0.35714285 -0.04081633]
 [ 0.34693878  1.          1.14285714]
 [ 0.34693878 -0.01020408  1.        ]]
[ 0.34693878 -0.35714286 -0.39795918]
Error: 1.92498604e-08

[ 0.34693878 -0.35714286 -0.39795918]
```

Omega 1.66

```
Iteración:49
[[ 1.          0.35714358 -0.04081615]
 [ 0.34693805  1.          1.14285751]
 [ 0.34693805 -0.01020425  1.        ]]
[ 0.34693805 -0.3571423  -0.39795876]
Error: 6.73001448e-06

Iteración:50
[[ 1.          0.3571423  -0.04081646]
 [ 0.34693933  1.          1.14285686]
 [ 0.34693933 -0.01020395  1.        ]]
[ 0.34693933 -0.35714328 -0.3979595 ]
Error: 5.1452163e-06

[ 0.34693933 -0.35714328 -0.3979595 ]
```

E. Para realizar el calculo del omega(w) óptimo la función utiliza un ciclo incrementando w en 0.01 iniciando en 0.01 y finalizando en 1.99 calculando la función sor_solver en cada iteración y validando la cantidad de iteraciones utilizadas.

```
function [w] = w_optimo (A, b , X0 , tol , num_max_it )
 it_aux = 100;
 w= 0.01;
 for i =0.01 : 0.01 :1.99
 [ x , nit , err acum ] =  sor_solver (A, b ,i, X0 , tol ,T , num_max_it  ) ;
 if ( nit <it_aux )
 w=i ;
 it_aux=nit ;
 endif
 endfor
 endfunction
```