Computational Physics - Assignment 3

Problem 3.a

Initial values guessed : 0.00, 1.80 and 1.90

```
0.00 # naive guess which gives 504 iterations
#1.80 gives us 401 iterations
#1.90 gives us 370 iterations
```

After the grid size was decreased by a factor of 2:

```
0.00 # naive guess which gives 1875 iterations
#1.80 gives us 1492 iterations
#1.90 gives us 1377 iterations
```

Problem 3.b

Yes, the final results are independent of the initial guess as shown by the code. Run the included code to check. (3A_2.py)

```
0.00 # naive guess which gives 756 iterations
#1.80 gives us 756 iterations
#1.90 gives us 756 iterations
```

Problem 3.c

The Gauß-Seidel method was implemented.
Run the code included. (3C.py)

```
0.00 # naive guess which gives 269 iterations
#1.80 gives us 217 iterations
#1.90 gives us 202 iterations
```

Problem 3.d

The SOR was implemented.

Without any charge,

-the Jacobi

```
0.00 # naive guess which gives 504 iterations
#1.80 gives us 401 iterations
#1.90 gives us 370 iterations
```

-the Gauß-Seidel

```
0.00 # naive guess which gives 269 iterations
#1.80 gives us 217 iterations
#1.90 gives us 202 iterations
```

-the SOR

```
0.00 # naive guess which gives 43 iterations
#1.80 gives us 37 iterations
#1.90 gives us 35 iterations
```

With charge,

-the Jacobi

```
0.00 # naive guess which gives 756 iterations
#1.80 gives us 756 iterations
#1.90 gives us 756 iterations
```

-the Gauß-Seidel

```
0.00 # naive guess which gives 392 iterations
#iterations are independent of the initial potential
```

-the SOR

```
0.00 # naive guess which gives 52 iterations
#iterations are independent of the initial potential
```

As shown above, without charges for 0.00 as an initial guess, the iterations show a rapid decrease from the Jacobi to the Gauß-Seidel to the SOR as expected. Even with charges, the trend remains the same.

Number of iterations for 0.00 as an initial value	Jacobi	Gauß-Seidel	SOR
Without charge	504	269	43
With charge	756	392	52