1. Use the Gauss-Seidel method up to five iterative loops to solve the following problem starting with $\mathbf{x} = \mathbf{0}$

$$\begin{bmatrix} 3 & 0 & -1 \\ 0 & 4 & -2 \\ -1 & -2 & 5 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 4 \\ 10 \\ -10 \end{bmatrix}$$

- a) Using a pedestrian implementation in a way you feel comfortable.
- b) Using the subroutines in piazza by modifying the segment between '... Modify below ...' and '... Up to here ...'. (See piazza for sample code).
- 2. Use the conjugate gradient method to solve the same linear system as in problem 1:
 - a) Using a pedestrian implementation in a way you feel comfortable.
 - b) Write an interface to the code below (posted on piazza) to supply Av(x) = A*x or by modifying the segment between '... Modify below ...' and '... Up to here ...'. (See piazza for sample code).

```
import numpy as np
import math
def conjGrad(Av,x,b,tol=1.0e-9):
    n = len(b)
    r = b - Av(x)
    s = r.copy()
    for i in range(n):
        u = Av(s)
        alpha = np.dot(s,r)/np.dot(s,u)
        x = x + alpha*s
        r = b - Av(x)
        if(math.sqrt(np.dot(r,r))) < tol:</pre>
            break
        else:
            beta = -np.dot(r,u)/np.dot(s,u)
            s = r + beta*s
    return x,i
```