Task 1

Consider the senate voting record of the 107th U.S. Congress (senate votes.txt) constructed from https://voteview.com. The adjacency matrix is an n × m matrix, representing the votes of n senators on m bills. Each element in the matrix has the value +1, -1 or 0, representing if a senator voted "yea", "nay", or did not vote on a bill respectively.

Write a Python script that performs the following:

1. Compute the SVD for the voting matrix. Use the SVD function in *linalg* from NumPy library and output U, and VT.
2. Implement the following dimensionality reduction techniques:
   a. Energy method.
   b. Entropy-based method.
3. Compute the voting matrix after dimensionality reduction using both techniques.

Task 2

Consider the matrix X

$$X = \begin{matrix} 2 & -3 \\ 1 & 6 \\ 5 & 2 \end{matrix}$$

1. Apply Centroid Decomposition (CD) to X by computing for each iteration:
   a. The maximizing sign vector z.
   b. The loading vector and the relevance vector
2. Consider the incomplete python implementation of the CD algorithm (centroid decomposition.py). Implement SSV (X, n,m) method to compute the maximizing sign vector z of matrix X with n rows and m columns.
3. Apply CD algorithm from centroid decomposition.py to the US voting matrix from Task1, and output the matrices L and R.