Problem 5:

    a.   Explain the rationale for sparse decomposition algorithms:

    b.   Describe & compare results in Figures 1 and 6

a. The canonical decompositions can be written as:

$$\det(\lambda B - A) = 0$$

Then, we compute extremal generalized eigenvalues using the following forms:

$$\lambda^{max}(A, B) = \max \frac{x^T A x}{x^T B x}$$

Then, we try to maximize the ratio. In the same time, we constrain the cardinality of the coefficient vector x. Mathematical formula could be described as:

$$maximize \; x^T A x / x^T B x$$
$$subject \; to \; Card(x) < \; k$$

where k > 0 is a given constant and Card(x) is the number of nonzero coefficients in x. This is sparse decomposition algorithm.

b. The first figure uses Box-Tiao decomposition while Figures 6 uses sparse canonical decomposition.