Sets of sequences with good correlation properties are desired in many active sensing and communication systems, e.g., multiple-input-multiple-output (MIMO) radar systems and code-division multiple-access (CDMA) cellular systems. In this paper, we consider the problems of designing complementary sets of sequences (CSS) and also sequence sets with both good auto- and cross-correlation properties. Algorithms based on the general majorization-minimization method are developed to tackle the optimization problems arising from the sequence set design problems. All the proposed algorithms can be implemented by means of the fast Fourier transform (FFT) and thus are computationally efficient and capable of designing sets of very long sequences. A number of numerical examples are provided to demonstrate the performance of the proposed algorithms.