Lab Session 7

1. This is a demonstration of image compression techniques using SVD. The following commands will first load a built-in 320×200 matrix X that represents the pixel image of a clown, computes its SVD $X = U\Sigma V^T$ and then displays the image when X is approximated by its best rank k approximation $X_k = \sum_{i=1}^{k} \sigma_i u_i v_i^T$ for a chosen value of k.

   ```
   load clown.mat; [U, S, V] = svd(X); colormap('gray');
   image(U(:, 1:k)*S(1:k, 1:k)*V(:,1:k)')
   ```

   The storage required for A_k is $k(m+n) = 520k$ words whereas the storage required for the full image is $n \times m = 6400$ words in this case. Therefore, $\frac{520k}{6400}$ gives the compression ratio for the compressed image. Also the error in the representation is $\frac{\sigma_{k+1}}{\sigma_1}$. Run the above commands for various choices of k and make a table that records the relative errors and compression ratios for each choice.

2. Perform experiments as suggested in Exercises 4.2.19-4.2.21 and 4.4.16 of *Fundamentals of Matrix Computations*. They are on pages 272-273 and 286-287 of second edition and pages 271-272 and 285 of third edition. Make a report on your experiments.