MATLAB Commands for Vectors and Matrices

MTHBD/CMPBD 424

- Vectors
  - v = [2 4 6] yields a row vector.
  - v = [2;4;6] or v = [2 4 6]’ yields a column vector.
  - v(2) yields the second element in v.
  - v(2:3) = yields elements 2 through 3 of v.
  - v(1) = 0 replaces the 2 with a zero
  - v(4) = 0 appends a zero to v now: v = [2 4 6 0]
  - [m,n] = size(v) yields (m = 1 and n = 3) or (m = 3 and n = 1)
  - v = 0:0.5:2 yields v = [0 0.5 1 1.5 2]
- Matrices
  - A = [1 2 3; 4 5 6; 7 8 9] or [1,2,3;4,5,6;7,8,9] (semicolon seperates rows)
  - [m,n] = size(A) yields m = number of rows in A and n = the number of columns in A.
  - A(1,2) yields the element in row 1 and column 2 of A.
  - A(:,2) yields the second column of A.
  - A(2,:) yields teh second row of A.
  - A(1:2,3:4) = yields rows 1 to 2 and columns 3 to 4 of A.
  - A([1 3 2],[1 3]) = yields rows 1 3 2 and columns 1 3 of A.
  - A + B yields term by term addition (appropriate dimensions reguired)
  - A * B yields normal matrix multiplication (appropriate dimensions required)
  - A∧2 = A * A
  - A.∧2 squares each entry in A.
  - A./2 divides each entry in A by 2.
  - cos(A) takes the cosine of each term in A.
  - eye(n) yields the n x n identity matrix
  - zeros(n,m) yields an n x m zero matrix
  - ones(n,m) yields an n x m matrix of all ones.
  - transpose(A) yields the transpose of A.
  - A’ = conjugate transpose (or just transpose if real)
  - inv(A) yields the inverse of A if one exists.
  - det(A) yields the determinent of A.
  - eig(A) yields a column vector of the eigenvalues of A.
  - [V,D] = eig(A) yields V a matrix with columns equal to ± the normalized eigenvectors of A, and D is a diagonal matrix with the eigenvalues in decreasing size from upper left.
  - x = A\b produces a solution to Ax = b. (forward slash).

- Matrix Factorizations
  - [L,U] = lu(A) returns and upper triangular matrix U and a (psychologically) lower triangular matrix L (ones on the diagonal) such that LU = A. (L is actually a permutation of a lower triangular matrix).
  - [L,U,P] = lu(A) returns and upper triangular matrix U and lower triangular matrix L (ones on the diagonal) such that LU = P A. So that to solve Ax = b use LU x = Pb.
  - R = chol(A) returns upper triangular R such that R*R'=A. Restrictions: A must be positive definite and hermitian (symmetric if real). An error is returned if either of these restrictions is violated.
  - [V,D] = eig(A) yields V a matrix with columns equal to $\pm$ the normalized eigenvectors of A, and D is a diagonal matrix with the eigenvalues in decreasing size from upper left. Note: AV = VD or A = VDV^{-1}.
- Vector Norms: V is a vector.
  - norm(V,P) = sum(abs(V).$\wedge$P)$\wedge$(1/P).
  - norm(V) = norm(V,2).
  - norm(V,inf) = max(abs(V)).
  - norm(V,-inf) = min(abs(V)).
- Matrix Norms: X is a matrix.
  - norm(X) is the largest singular value of X, max(svd(X)).
  - norm(X,2) is the same as norm(X).
  - norm(X,1) is the 1-norm of X, the largest column sum, = max(sum(abs((X)))).
  - norm(X,inf) is the infinity norm of X, the largest row sum, = max(sum(abs((X'')))).
  - norm(X,'fro') is the Frobenius norm, sqrt(sum(diag(X'*X))).
  - norm(X,P) is available for matrix X only if P is 1, 2, inf or 'fro'.
- Condition Numbers: X is a matrix.

  cond(X,p) is the condition number of a matrix X using the p-norm. Values of p can be 1, 2, inf, or 'fro'.