Linear Inequalities
Homework 0

Please use this homework to test your preparedness for the course. Please refer to chapter 1 of the textbook or basic references for a quick refresher.

1. Define the following

   (a) Convex set, convex hull, convex cone, convex function, polytope, polyhedron, Ball in n-dimensions, Ellipsoid.

   (b) Linear independence, Affine combination of vectors, Linear combination of vectors, Vector space, orthogonal vector space.

   (c) Linear Subspace, determinant, inverse matrix, Gaussian Elimination, Row rank, Column rank, Rank of a matrix, Singular Matrix, Null space of a matrix, Orthogonal space, Non-singular matrix, Positive Definite Matrix, Positive Semi-definite matrix.

   (d) Graph, Tree, Forest, connected graph, subgraph, planar graph, path, Hamiltonian path, Hamiltonian circuit, clique, matching, independent set, bipartite graph, coloring.

   (e) Given a parameter n, what is $O(n), o(n), \Omega(n), \omega(n)$ (Big-Oh, Small-Oh, Big-Omega, small-Omega).

   (f) Class P, Class NP, Class NP-complete, class *co-*NP.

2. Show the following.

   (a) For any matrix M, the row rank of M equals the column rank of M.

   (b) Give an algorithm to check whether a graph is connected. Give an algorithm to find a shortest path between two vertices s and t in a graph.

   (c) Given a matrix A, how does one compute the inverse of A, determinant of A and rank of A?