Problem 1. Can this incidence graph be a valid two-manifold solid’s boundary? If yes, sketch a 3-D figure satisfying the incidence graph, otherwise explain. Below, $F_i$ are planar faces, $e_j$ are edges, and $V_k$ are vertices.

Problem 2. Can this incidence graph be a valid two-manifold solid’s boundary? If yes, sketch a 3-D figure satisfying the incidence graph, otherwise explain. Below, $F_i$ are planar faces, $e_j$ are edges, and $V_k$ are vertices.
Problem 3. Given a cube, which has one solid volume, six faces, twelve edges, and eight vertices, please develop a procedure, using Euler operators, to subdivide it so that each subdivided 3-D solid is a tetrahedron and every tetrahedron is connected to one point. Draw a figure that demonstrates your result.

Problem 4. Verify the fact that a complete binary tree with depth $k$ has $2^{k+1} - 1$ nodes. How many nodes are there in a complete quadtree and a complete octree?

Problem 5. Show that for the octree representation of a homogeneous object, the storage requirements are a function of the surface area of boundary, rather than volume.