Spring 2026, Math 590: Week 7 Preliminary Problems
Due: Wednesday, March 18th, 2026
Faces of Polyhedra

Preliminary problems. These problems should be completed before discussion on Wednesday.

(P1) Draw the polytope

$$P = \text{conv}\{(0,0,0),(1,0,0),(0,1,0),(1,1,0),(0,0,1)\} \subset \mathbb{R}^3.$$

(P2) Write down an inequality $a_1x_1 + a_2x_2 + a_3x_3 \leq b$ that defines a half-space demonstrating $\emptyset$ is a face of P.

(P3) Write down an inequality $a_1x_1 + a_2x_2 + a_3x_3 \leq b$ that defines a half-space demonstrating P is a face of P.

(P4) Let

$$v_1 = (0,0,0), \quad v_2 = (1,0,0), \quad v_3 = (0,1,0), \quad v_4 = (1,1,0), \quad \text{and} \quad v_5 = (0,0,1).$$

Write down each subset of the vertices of P whose convex hull is a face of P. To conserve space/ink/sanity, omit commas, curly-braces, and v's, writing e.g., 124 for $\{v_1, v_2, v_4\}$.

Note: there are 20 faces total.