You are allowed to work in groups, but the solutions you hand in should be written by you only. If you work in a group, you must write the names of your collaborators at the top of your assignment. Explain your reasoning to receive full credit. All problems are worth 10 points. You are strongly encouraged to type your solutions in LaTeX. In any case, please staple your psets!

\textbf{P1} Let the polytope $P$ be the convex hull of points $(0,0), (1,0)$ and $(0,1)$ in $\mathbb{R}^2$. For each face of $P$ write down a valid inequality for $P$ which defines the face (and explain how you get the face from it). Count the number of faces of $P$ of each dimension.

\textbf{P2} Recall from class that for a polytope $P$ the \textbf{face poset} $(S, \leq)$ is given by: $S$ is the set of all faces of $P$, and the relation $\leq$ is given by inclusion. Recall that in class we drew the face poset of a polytope as graphs with vertex set the faces of $P$ and by connecting faces $G$ and $F$ with an edge emerging upwards from $G$ towards $F$ if $G \subset F$ and $\dim F = \dim G + 1$.

Draw down the face poset of the 3-cube and the face poset of the octahedron. Do you observe anything about these poset?

\textbf{P3} Draw down the face poset of a 2-cube. List all chains of the poset and also all maximal chains together with their lengths. Is this poset graded? Is it bounded? Is it a lattice? For each answer give a justification based on the definitions.