Directions: You may work to solve these problems in groups, but all written work must be your own. **Show your work**; See "Guidelines and advice" on the course webpage for more information.

1. For each of the following graphs, either give a planar drawing or show that the graph contains a subdivision of K_5 or $K_{3,3}$.



- 2. Suppose that a connected k-regular planar graph G is drawn so that every face has length ℓ . Find a formula for the number of faces of G in terms of k and ℓ .
- 3. Find all perfect matchings in the cube. How many are there?



4. Find a maximum matching in the following bipartite graph and a set $S \subseteq X$ whose deficiency proves the matching is maximal.

