1. Determine the number of edges in a complete graph on n vertices.

2. Let $d \in \mathbb{N}$ and $V = \{0,1\}^d$. That is, V is the set of all binary sequences of length d. Define a graph on V in which two sequences form an edge if and only if they differ in exactly one position. (This graph is called the **d-dimensional cube**.)

   (a) Draw and label the vertices of the 1-, 2-, and 3-dimensional cube.

   (b) Determine the average degree, number of edges, diameter, girth and circumference of the d-dimensional cube.

3. Let G be a graph containing a cycle C, and assume that G contains a path of length at least k between two vertices of C. Show that G contains a cycle of length at least $\sqrt{k}$.

4. Proposition 1.3.2 states that every graph G containing a cycle satisfies $g(G) \leq 2\mathrm{diam}(G) + 1$. Is this bound best possible? Prove your answer is correct.

5. Show that for every graph G, $\mathrm{rad}(G) \leq \mathrm{diam}(G) \leq 2\mathrm{rad}(G)$.