This exercise continues our exploration of graphs, with the *powers* and *derivatives* of graphs, and *Hamiltonian circuits*.

1. List the members of your group below:

2. The *kth power* of a graph $G = (V, E)$ is the graph $G^k = (V, F)$ where F contains precisely those pairs of vertices that are connected in G by a path of length at most k.

   Depict G^k for $k = 1, 2, 3$ for each of the following choices for G: K_5, $K_{4,5}$, P_5, C_5, W_5, and S_5. (Recall the definitions from the homework.)

[additional space for answering the earlier question]

3. The *derivative* of a graph G is the graph $G^{(')}$ obtained from G by removing all vertices of degree 1, along with the edges incident on them. (Recall that the degree of a vertex is the number of edges incident on it.)

   Depict $G^{(')}$ for each of the following choices for G: K_5, $K_{4,5}$, P_5, C_5, W_5, and S_5.

4. A *Hamiltonian circuit* in a graph is a closed path that visits each vertex exactly once (not counting the return to the origin as a visit). A graph is called *Hamiltonian* if it admits a Hamiltonian circuit.

   For each of the graphs of Questions 3 and 2, determine whether the graph is Hamiltonian. If so, exhibit a Hamiltonian circuit; otherwise, explain why no Hamiltonian circuit exists.