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 $k$th 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 $G^{(r)}$ 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 $G^{(r)}$ 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.