Alex Lutsch
Ephraim Siegfried

Exercise 9.1

1. This statement is false. This will be shown with a counterexample.Let $G = (\{a, b, c\}, \{\{a, b\}, \{b, c\}\}$. G is connected, because we can reach every vertex from every vertex. The Graph $G' = (\{a, c\}, \emptyset)$ is an induced subgraph of G, since it is formed from a subset of the vertices from G and the vertices a, c are not connected in G. G' is not connected. We have the case that G is connected but the induced graph G' is not connected. Therefore the statement is false.

2. This statement is correct. A forest is a graph without cycles, essentially a collection of trees. An induced subgraph of a forest will also be cycle-free, as removing vertices and their associated edges cannot create a cycle where there was none before. Therefore, any induced subgraph of a forest is also a forest.

3. If a graph is a tree, then it must also be connected. Because the statement in a) is false, this statement must also be false, i.e. it is not guaranteed that an induced graph of a connected graph is connected. But this would be required for the statement: "If G is a tree, then all its induced subgraphs are trees. "

Exercise 9.2

Exercise 9.3

1. The graph G has 2 cycles $\{\{J, N, L\}, \{L, I, K\}\}$ of length 3. The given graph has three cycles $\{1, 2, 4\}, \{4, 7, 6\}, \{6, 7, 8\}$ of length 3. The graphs don't have the same properties and are therefore not isomorphic.

2. $\sigma = \{H \to 2, J \to 5, N \to 8, L \to 4, O \to 7, K \to 3, I \to 6, M \to 1\}$

Exercise 9.4

Exercise 9.5