Problem Set 9 **Foundations** **Due 4/15/19**

Four of these problems will be graded, with each problem worth 5 points. Clear and complete justification is required for full credit. You are welcome to discuss these problems with anyone and everyone, but must write up your own final submission without reference to any sources other than the textbook and instructor.

1. Let $S = \{a, b, c, d, e\}$ and $\Pi = \{\{a, e\}, \{b, c\}, \{d\}\}$. Write the relation R corresponding to the partition Π.
2. Let S be a set and Π a partition of S defined by $a \sim b \Leftrightarrow \exists P \in \Pi$ for which $a, b \in P$. Then Π is a reflexive relation.
3. Let S be a set and Π a partition of S defined by $a \sim b \Leftrightarrow \exists P \in \Pi$ for which $a, b \in P$. Then Π is a symmetric relation.
4. Let S be a set and Π a partition of S defined by $a \sim b \Leftrightarrow \exists P \in \Pi$ for which $a, b \in P$. Then Π is a transitive relation.

We say that two vertices v_1 and v_2 of a graph G are **in the same component of** $G \Leftrightarrow \exists$ a walk from v_1 to v_2.

5. The relation of being in the same component of a graph is reflexive.
6. The relation of being in the same component of a graph is symmetric.
7. The relation of being in the same component of a graph is transitive.

We say that two vertices v_1 and v_2 of a graph G are **on a common cycle of** $G \Leftrightarrow \exists$ a cycle including v_1 and v_2.

8. The relation of being on a common cycle of a graph is reflexive.
9. The relation of being on a common cycle of a graph is symmetric.
10. The relation of being on a common cycle of a graph is transitive.