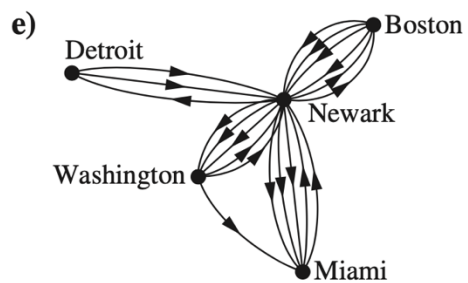
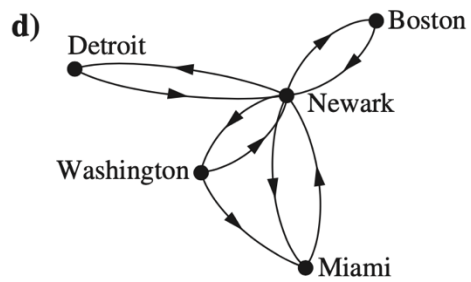
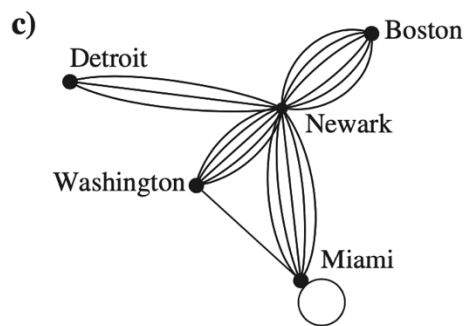
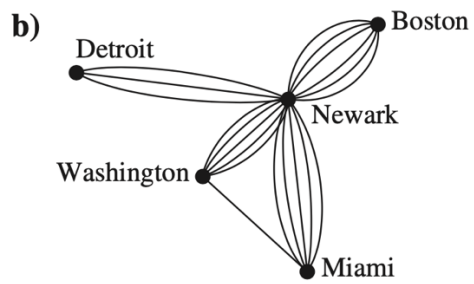
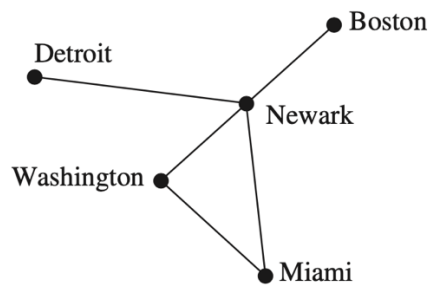
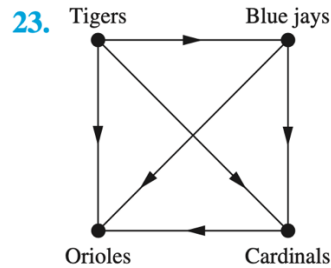


1. a)



9. Directed multigraph **11.** If uRv , then there is an edge associated with $\{u, v\}$. But $\{u, v\} = \{v, u\}$, so this edge is associated with $\{v, u\}$ and therefore vRu . Thus, by definition, R is a symmetric relation. A simple graph does not allow loops; therefore, uRu never holds, and so by definition R is irreflexive.



who had recently changed his or her e-mail address. **29.** Let V be the set of people at the party. Let E be the set of ordered pairs (u, v) in $V \times V$ such that u knows v 's name. The edges are directed, but multiple edges are not allowed. Literally, there is a loop at each vertex, but for simplicity, the model could omit the loops. **31.** Vertices are the courses;