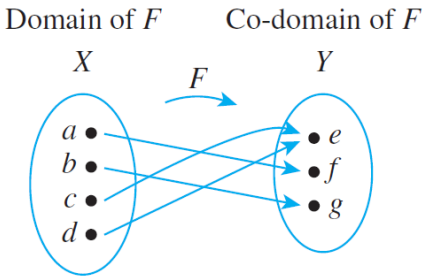
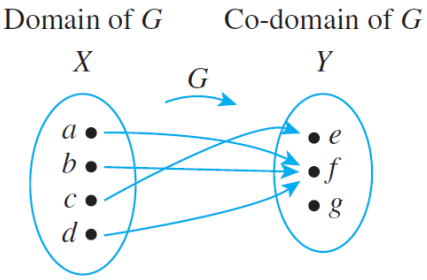
EE2302 Foundations of Information Engineering

Assignment 2 **Due: 6 pm, Sep 15**

Full mark: 16 points

1. (6 points) Let $X = \{a, b, c, d\}$ and $Y = \{e, f, g\}$. Define functions F and G by the arrow diagrams below.





   a) Is F one-to-one? Why or why not?
   b) Is F onto? Why or why not?
   c) What is the range of F?
   d) Is G one-to-one? Why or why not?
   e) Is G onto? Why or why not?
   f) What is the range of G?

2. (4 points) Define $g: \mathbb{R} \to \mathbb{R}_+$ by the rule $g(x) = x^2$, where $\mathbb{R}$ denotes the set of all real numbers and $\mathbb{R}_+$ denotes the set of all non-negative real numbers.
   a) Is g injective? Prove it or disprove it by giving a counterexample.
   b) Is g surjective? Prove it or disprove it by giving a counterexample.

3. (3 points) If $f: X \to Y$ and $g: Y \to Z$ are both injections, prove that $g \circ f$ is an injection.

4. (3 points) Does the interval (0, 1) have the same cardinality as the interval (10, 100)? Prove or disprove it.