Homework Assignment 9
CS 2233
Section 001 and Section 002
Due: Friday, April 26

Problem 1. [10 points]
Complete all participation activities in zyBook sections 6.1-6.3

Problem 2. [25 points]
a. [5 points] List all of the ordered pairs in the relation $R = \{(a, b)|\ a + b \text{ is even}\}$ on the set $\{1, 2, 3, 4, 5\}$

b. [10 points] For each of the following relations on the set of all people, determine if the relation is necessarily reflexive, symmetric, antisymmetric, and/or transitive.
        1) [5 points] $R_1 = \{(a, b)|\text{There is a book that both } a \text{ and } b \text{ have read}\}$
        2) [5 points] $R_2 = \{(a, b)|a \text{ has a higher gpa than } b\}$

c. [10 points] For each of the following relations on the set of real numbers, determine if the relation is reflexive, symmetric, antisymmetric, and/or transitive.
        1) [5 points] $R_3 = \{(x, y)|x - y = 0\}$
        2) [5 points] $R_4 = \{(x, y)|x < y \lor y < x\}$

Problem 3. [25 points] Let F be the set of all functions from integers to integers. For each of the following relations on F, determine if the relation is reflexive, symmetric, and/or transitive.
a. [5 points] $\{(f, g)|f(1) = g(1)\}$
b. [5 points] $\{(f, g)|f(0) = g(0) \text{ or } f(1) = g(1)\}$
c. [5 points] $\{(f, g)|f(x) - g(x) = 1 \text{ for all } x \in \mathbf{Z}\}$
d. [5 points] $\{(f, g)|\text{ for some } C \in \mathbf{Z}, \text{ for all } x \in \mathbf{Z}, f(x) - g(x) = C\}$
e. [5 points] $\{(f, g)|f(0) = g(1) \text{ and } f(1) = g(0)\}$

Problem 4. [5 points] List the 4-tuples that are in the relation $\{(a, b, c, d)|a, b, c, d \in \mathbf{Z}^+ \text{ and } abcd = 6\}$

Problem 5. [30 points] For the following directed graph:
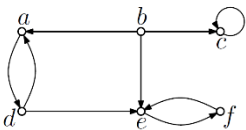
a. [5 points] Specify the set of vertices
b. [5 points] Specify the set of edges.
c. [5 points] Give the in-degree of each vertex
d. [5 points] Give the out-degree of each vertex
e. [5 points] Is there a path from vertex a to vertex f?
f. [5 points] Is there a path from vertex f to vertex a?