CECS 228 Name:

Lab 6.1 ID: Date:  
Objective:

* Be able to identify a relation
* Be able to identify properties of a relation
* Be able to represent relation using digraphs and matrices.

Exercise 1: List the ordered pairs in the relation R from A = {0, 1, 2, 3, 4} to B = {0, 1, 2, 3}, where (a, b) ∈ R if and only if

a) a = b.

b) a + b = 4.

c) a | b

d) gcd(a, b) = 1.

Exercise 2: Determine whether the relation R on the set of all integers is reflexive, symmetric, antisymmetric, asymmetric, and/or transitive, where (x, y) ∈ R if and only if (explain your reasoning)

a) xy ≥ 0.

b) x = 1 or y = 1.

c) x – y = rational number

Exercise 3: For each of these relations on the set {1, 2, 3, 4}, decide whether it is reflexive, whether it is symmetric, whether it is antisymmetric, whether it is asymmetric, whether it is irreflexive and whether it is transitive.

a) {(2, 2), (2, 3), (2, 4), (3, 2), (3, 3), (3, 4)}

b) {(2, 4), (4, 2)}

c) {(1, 3), (1, 4), (2, 3), (2, 4), (3, 1), (3, 4)}

Exercise 4:  
R1 = {(a, b) ∈ | a > b}, the “greater than” relation,

R2 = {(a, b) ∈ | a ≥ b}, the “greater than or equal to” relation,

R3 = {(a, b) ∈ | a < b}, the “less than” relation,

R4 = {(a, b) ∈ | a ≤ b}, the “less than or equal to” relation,

R5 = {(a, b) ∈ | a = b}, the “equal to” relation,

R6 = {(a, b) ∈ | a ≠ b}, the “unequal to” relation.  
a) R1 ∪ R3.

b) R2 ∩ R4.

c) R1 − R2.

Exercise 5:   
A. Represent each of these relations on {1, 2, 3} with a matrix (with the elements of this set listed in increasing order).  
B. Draw the digraphs representing each of the relations below.  
C. Determine whether the relations represented by the directed graphs in part B are reflexive, symmetric, antisymmetric, asymmetric, irreflexive and/or transitive.

a) {(1, 1), (1, 2), (1, 3)}

A. B C

b) {(1, 2), (2, 1), (2, 2), (3, 3)}

A. B C

c) {(1, 1), (1, 2), (1, 3), (2, 2), (2, 3), (3, 3)}

A. B C

d) {(1, 3), (3, 1)}

A. B C