Tutorial 3

Relations

Q.1 Relation

Let $A = \{1, 2, 3, 4\}$. Define a relation R on A by

$$R = \{(1,2), (1,3), (2,3), (4, 4)\}.$$

a) Is it reflexive?
b) Is it symmetric?
c) Is it antisymmetric?
d) Is it transitive?

Q.2 Properties of Relation

Let A be the set of all lines in the 2-dimensional plane. Let R be the relation on A defined by

$$l_1 R l_2 \text{ iff } l_1 \text{ is perpendicular to } l_2.$$

a) Is it reflexive?
b) Is it symmetric?
c) Is it antisymmetric?
d) Is it transitive?

Q.3 Equivalence Relation

Let S be the set of all digital logic circuit with two inputs and one output.

Let R be defined on S as follows:

$c_1 R c_2$ iff c_1 has the same input/output table as c_2.

a) *Is* R an equivalence relation ? Why?

1. Yes
2. No

Q.3 Equivalence Relation

Let S be the set of all digital logic circuit with two inputs and one output.

Let R be defined on S as follows:

$c_1 R c_2$ iff c_1 has the same input/output table as c_2.

b) How many distinct equivalence classes are there?

1. 2^4
2. 2^3
3. 2^2

Q.3 Equivalence Relation

Let S be the set of all digital logic circuit with two inputs and one output.

Let R be defined on S as follows:

$c_1 R c_2$ iff c_1 has the same input/output table as c_2.

c) Find two different circuits that are in the same equivalence class.

Q.4 Partial Order

Let $A = \{2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15\}$.

Consider the relation R on A defined as

$$xRy \text{ iff } x \text{ is a factor of } y.$$

a) Is R a partial order? Why?
   1. Yes
   2. No

b) List all maximal elements.

c) List all minimal elements.

Q.5 Congruence

Let $a \equiv b \pmod{n}$ and $c \equiv d \pmod{n}$.

Is $a + c \equiv b + d \pmod{n}$ right? Prove or disprove it.

1. Yes
2. No