

CSI 35 LECTURE NOTES (Ojakian)

Topic 6: Relations

OUTLINE

(References: Wells 51 - 53, 55 - 59, 117, 129, 130, 132 - 137; Rosen: 9.1, 9.2, 9.3)

1. Relations: Definitions and Examples
 2. Database Application
 3. Properties: Functional, Reflexive, Symmetric, Antisymmetric, Transitive
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1. Relations

- (a) Binary and n -ary
 - i. Subset of Cartesian product.
 - ii. Notations: $(a, b) \in R$, or $R(a, b)$, or aRb .
 - iii. Do some small finite examples.
- (b) Some more involved examples.
 - i. $<$ on the rationals
 - ii. Congruence mod n
 - iii. (x, x^2) and (x^2, x) , for x real.
 - iv. $\{(x, y, z, n) \mid x, y, z, n \text{ are positive integers and } x^n + y^n = z^n\}$

2. Representing Relations (mostly binary ones)

- (a) Table or listing
- (b) Graph “on the plane”
- (c) Two columns with arrows
- (d) Digraph
- (e) Matrix

3. Functions

- (a) Example: (x, x^2) versus (x^2, x) from above.
- (b) Definition of “functional relation” or a “relation which is a function”.
- (c) The “Vertical Line Test”.
- (d) Consider some small finite examples, some are, some are not.

4. Viewed as databases

Do in theory and sqlite.

- (a) Examples 11 and 12 (Section 9.2)
- (b) Have various “tables”
 - i. Each column has a name and type
 - ii. Each row is an item
 - iii. Entire table can be viewed as n-ary relation
- (c) Create table
 - i. “CREATE TABLE [table] ([col1] [type1], [col2] [type2], ...)”
- (d) Build database with Insert command
 - i. “INSERT INTO [table] VALUES (value1 , value2, value3 ...)”
- (e) Retrieve data with Select command
 - i. “SELECT [columns] FROM [table] WHERE columns = [...] “

5. Typical Properties for Binary Relations on a Set

- (a) Definition: Binary relation on a set.
- (b) Reflexive
 - i. Example: $\leq$ and $<$
- (c) Symmetric (and anti-Symmetric)
 - i. Example: Congruence and $\leq$
 - ii. Do Rosen 9.1, 49 (Mistaken Proof).
- (d) Transitive
 - i. Example: $\leq$
 - ii. Hasse Diagrams for Transitive relations

6. Examples for Reflexive, Symmetric, and Transitive

PROBLEM 1. *Do Wells 59.1.3*

PROBLEM 2. *Do Wells 55.1.9.*

PROBLEM 3. *Do Wells 56.1.4.*

PROBLEM 4. *Do Wells 59.1.4.*

PROBLEM 5. *Begin Wells 58.1.10 (finishing it will be a question on the next class work).*

7. More Exercises

- (a) Section 9.1: 2, 3, 4, 6, 7, 10
- (b) Section 9.2: 2, 28b
- (c) Section 9.3 (skip any “irreflexive”): 1 - 10, 22 - 32