

Math 322

Math = toys \oplus rules

(A.D.S. ch 6-7) Relations and Functions

Relationships between many sets.

(n-ary relations)

Sets: S_1, S_2, \dots, S_n

relation event:

ordered n-tuple
ex: (Mark, brown, green)
↑ ↑ ↑
people shoes pants

n-ary relationship = set of ordered n-tuples.

→ n-ary relationship is a subset of $S_1 \times S_2 \times \dots \times S_n$

(ex) $A = \{a, b, c\}$ $B = \{\alpha, \beta\}$
 $A \times B = \{ \underline{(a, \alpha)}, \underline{(a, \beta)}, \underline{(b, \alpha)}, \underline{(b, \beta)}, \underline{(c, \alpha)}, \underline{(c, \beta)} \}$

$$|A \times B| = |A| |B|$$

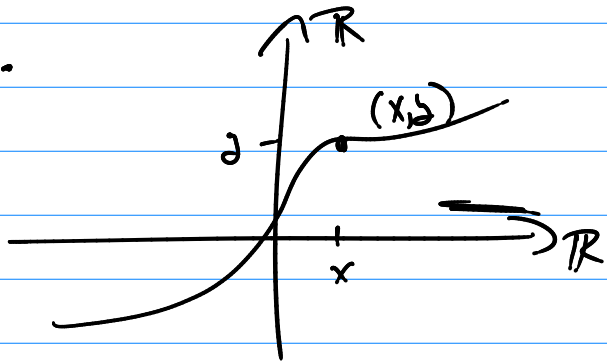
$$|\text{all subsets}| = |P(S)| = 2^{|S|}$$

② 2-ary relation / binary relation

or just relation from set A to set B.

is a subset of $A \times B$.

④ in calculus $\mathbb{R} \times \mathbb{R}$



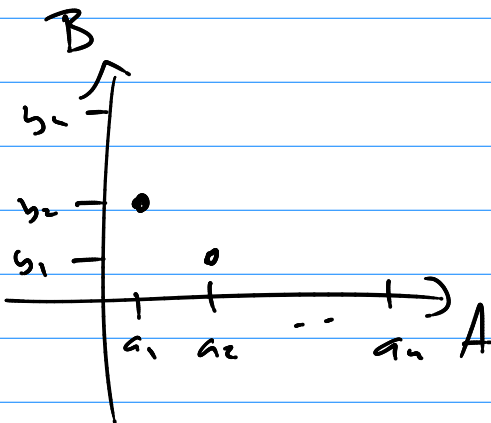
③ relation on a single set
- subsets of $A \times A$

Representing

① table:

R	b_1	b_2	...	b_n
a_1				
a_2	X			
...				
a_n				

(Some thing or $(a_i, b_j) \in R$)



② list: $R = \{ (a_1, b_2), (a_2, b_1), \dots \}$

③

zero-one matrix

$$M_R = [a_{ij}]$$

$$a_{ij} = 1 \quad (a_i, a_j) \in R$$

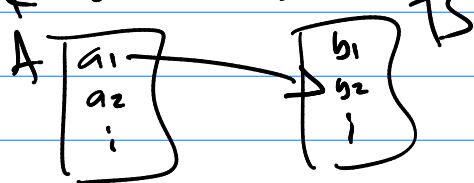
$$a_{ij} = 0 \quad (a_i, a_j) \notin R$$

R on set

④

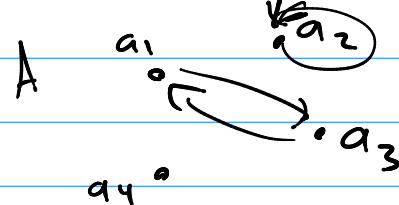
directed graph

R on $A \times B$



R on A

$$R = \{ (a_1, a_2), (a_2, a_2), (a_3, a_1) \}$$



digraph

arrow diagram

Q

R on $A = \{1, 2, 3, 4\}$ is...

$$R = \{(a, b) \mid a < b\} \leftarrow$$

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

② tbl:

R	1	2	3	4
1		x	x	x
2			x	x
3				x
4				

③

$$M_R = \begin{bmatrix} 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

④ digraph

