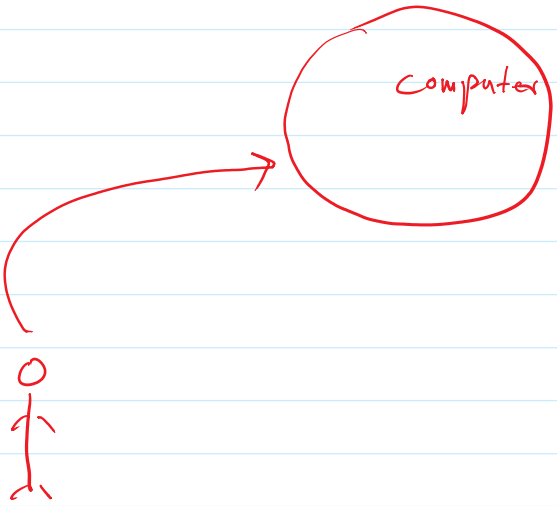
lec 10 :-

Relations .

تعلقات
تعلق



Binary Relation :-

A binary relation between two set A & B is a subset of AxB.

Singelton .

$A = \{1, 2\}$ $B = \{a, b\}$.

$A \times B = \{(1,a), (1,b), (2,a), (2,b)\}$.

tuple .

$A \times B \neq B \times A$.

$\{1,2\} = \{2,1\}$.

$\{(1,2)\} \neq \{(2,1)\}$.

$\{(1,2), (3,2)\} = \{(3,2), (1,2)\}$

$|A|$ = # of elements in A. = 2.

$|B| = 2$.

$|A \times B| = |A| \times |B| = 2 \times 2 = 4$.

$A \times B = \{(1,a), (1,b), (2,a), (2,b)\}$.

$\{\phi\}$, $\{(1,a)\}$, $\{(1,b)\}$, $\{(2,a)\}$, $\{(2,b)\}$,
$\{(1,a), (1,b)\}$, ~ ~ ~ ~ ~ ~
9 more (HW).

$|A \times B| = |A| \times |B| = 2 \times 2$.

I move (n vv).

$|Pow(A \times B)| = 2^{|A \times B|} = 2^{|A| \times |B|} = 2^{2 \times 2} = 2^4 = 16.$

$A = \{1, 2\}.$

$P(A) = \{\phi, \{1\}, \{2\}, \{1, 2\}\}.$

$|P(A)| = 2^{|A|} = 2^2 = 4.$

Ex: $A = \{$ Tomato, Grape$\}$.

$A \times A$ Relations. ?

$|Pow(A \times A)| = 2^{|A \times A|} = 2^{|A| \times |A|} = 2^{2 \times 2} = 2^4 = 16.$

$A = \{$ Tomato, Grape, Apple$\}$.

$A \times A$ Relations ?

Ex: $R = \{(a, b) \in A \times A \mid a$ divides $b\}$. $A = \{1, 2, 3, 4\}$.

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

512
812
8
10
16 2

Set builder Notation.

$\{ \quad | \quad \}$.

↓ Syntax ↓ Semantics.

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

Exs:- $R_1 = \{(a,b) \mid a \leq b\}$ $A = \{1,2,3,4\}$.

$R_2 = \{(a,b) \mid a > b\}$.

$R_3 = \{(a,b) \mid a = b\}$.

$R_4 = \{(a,b) \mid a = b+1\}$.

$R_5 = \{(a,b) \mid a+b \leq 1\}$.

$pow(A \times A) = 2^{|A \times A|} = 2^{4 \times 4} = 2^{16} =$ ——

Relations Properties.

1- Reflexive. $\forall a \in A \quad (a,a) \in R$. 2^{16}.

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

$\rightarrow (1,1) \in R \wedge (2,2) \in R \wedge (3,3) \in R \wedge (4,4) \in R$.

$\{\} \checkmark$

$\{(1,1)\}$ X

$\{(2,2)\}$ X

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

$A = \{a,b\}$.

$A \times A = \{(a,a),(a,b),(b,a),(b,b)\}$.

$pow(A \times A) = \{\{\}^{\checkmark}, \{(a,a)\}^{X}, \{(a,b)\}^{X}, \{(b,a)\}^{X}, \{(b,b)\}^{X}, \{(a,a),(b,b)\}^{\checkmark}, \{(a,a),(a,b)\}^{X}, \{(a,a),(b,a)\}^{X}, \ldots$

$A = \{\}$

$A \times A = \Phi$

$pow(A \times A) = \{\Phi\}$.

Symmetric: $\forall a,b \in A$ if $(a,b) \in R \rightarrow (b,a) \in R$.

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

$R = \{\}$.

$R = \{(1,1)\}$. ✓

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

$(1,2) \in R \rightarrow (2,1) \in R \wedge$
$(1,1) \in R \rightarrow (1,1) \in R$.

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

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

$A = \{a,b\}$.

How many Symmetric Relation,