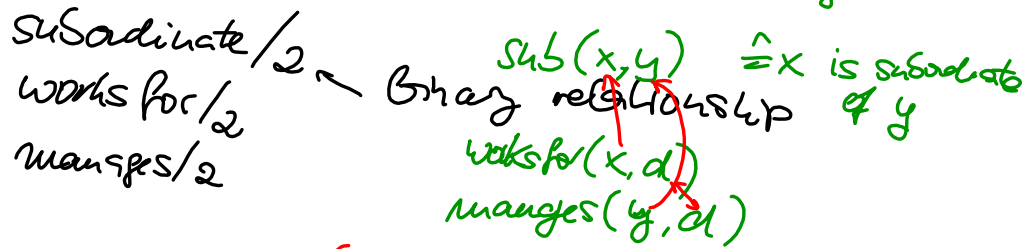


Consider Slide 22

directed "edges"



Conceptual Correspondence

Not expressed in the ER Diagram:

DL:  $\exists y: manages(?x, sales)$   
 $sub \sqsupseteq works\ for \circ manages$  ← going back from  $ol$  to  $y$

FOL:  $\forall x,y,d: sub(x,y) \leftarrow works\ for(x,d) \wedge manages(y,d), \wedge x \neq y$

database state  $\varphi \neq \varphi$  formula =  $\varphi$

↑  
a FOL sentence

SL24, queries SQL vs FOL (reasoning)

• Who manages the sales dept?  
 select name from manages where dept = "sales"  
 → 

name
Alice

for which values of  $x$ ?  
 $\varphi \neq manages(?x, sales)$   
 Answers:  $x$ /Alice

• who does not manage the sales dept  
 select name from person where not (name, 'sales') in (select \* from manages)

→ 

name
Bob
John
Larry

$\varphi \neq \neg manages(?x, sales)$   
 She we all  $x \in \mathcal{D}$  where  $\varphi \neq manages(x, \mathcal{D})$   
 not "domain-independent"  
 $\varphi = (\mathcal{D}, I)$   
 "active domain"

⇒ make it domain-independent  
 $\varphi \neq person(x) \wedge \neg manages(x, sales)$

↙

$\rightarrow$  reasoner: query data  $\rightsquigarrow$   $\mathcal{Q} \models \text{person}(\text{alice})$   
 $\wedge \text{manages}(\text{alice}, \text{sales})$   
 $\Rightarrow \mathcal{Q} \not\models \text{person}(\text{alice})$   
 $\wedge \neg \text{manages}(\text{alice}, \text{sales})$

Consider Larry:

$\mathcal{Q} \models \text{person}(\text{larry})$

$\mathcal{Q} \models \neg \text{manages}(\text{larry}, \text{sales})$

$\Rightarrow$  Can't delete this since each dept has only one manager

$\Rightarrow$  alice is not an answer