

Database Design

... E-R Diagrams
example case

Designing an E-R Model/Diagram

Step 1: Collect & review ALL the data.

Step 2: Identity **entities** & **attributes** draw them on your ER diagram

Step 3: Identify the **key attribute(s)** and underline them on your diagram

Step 4: Decide on the **relationships** and draw lines between the entities, including any **attributes** of the relationships.

Step 5: Decide on the **cardinality** of each relationship and add it to the diagram

Step 6: Decide on the **participation** of each entity in each relationship and *add* if required.

Step 7: Add the **foreign keys** of each relationship for each entity pairs and *add* relationship attributes if present.

MIS – Database I - ERD

E-R Example

- In a Doctor's Office
 - Nurses work for the Doctor in the office
 - Each Nurse works for (assigned to) a single Doctor
 - Every Doctor has one or more Nurses working for (assigned) them
 - Each Nurse has a first name, last name and a unique Nurse's ID
 - Each Doctor has a first name, last name and a unique Doctor's ID
 - Only a Doctor can order a type of Test, but not all Doctors order Tests
 - Each type of Test has a unique Test ID number and the name of Test
 - If known, keep track of the hours per week worked by the Nurse.
 - We need to keep track of the **date** that any **Test** order was placed

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Step 1: Identify the Entities
along with their attributes
and eventual relationships.

NURSE

nurse ID
lastName
firstName

DOCTOR

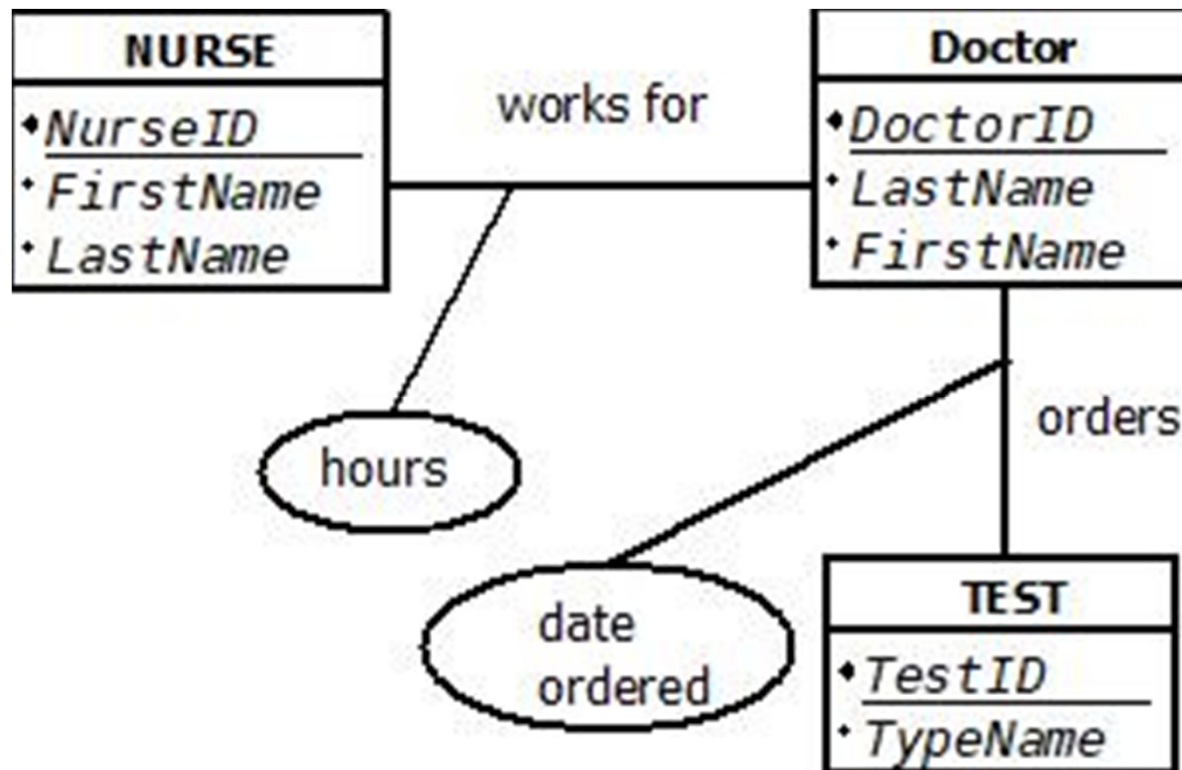
doctor ID
lastName
firstName

TEST

test ID
type

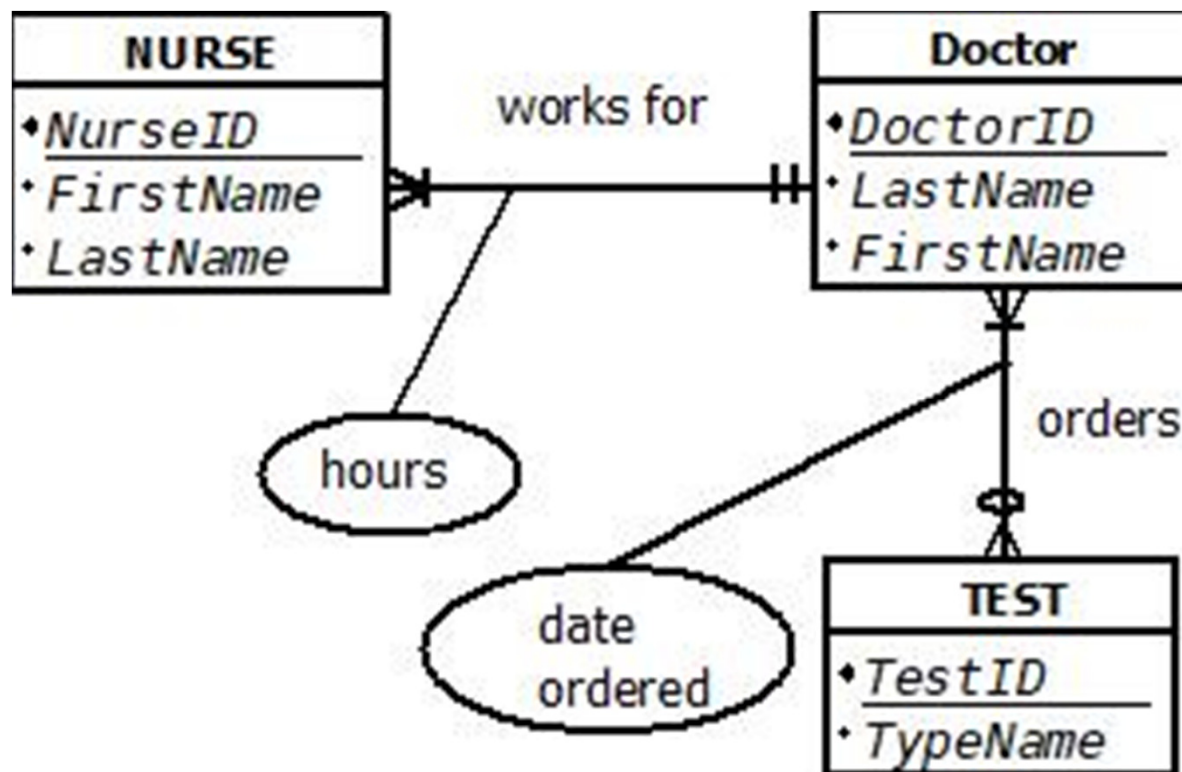
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Step 5: Doctors have **many** Nurses working for them. Each Nurse works for (assigned to) only **one** Doctor.



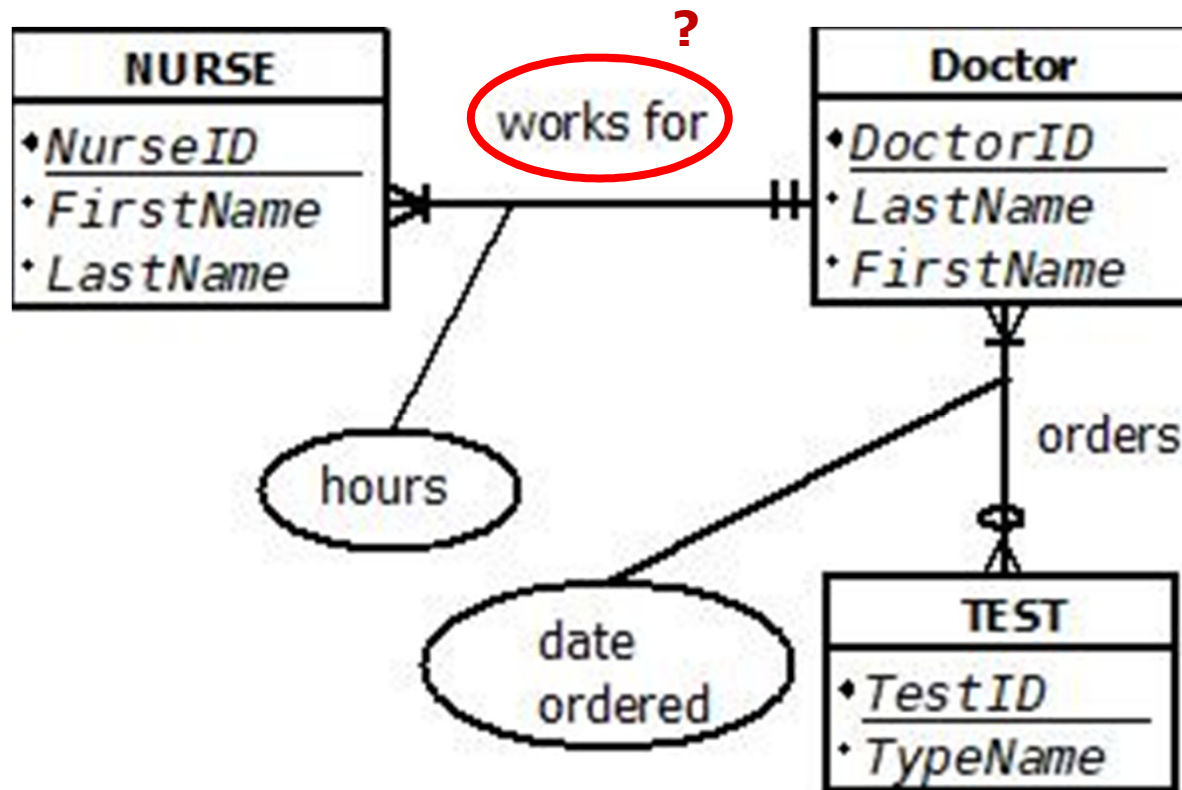
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Step 6: Only a Doctor can **order** a test, **but not all Doctors order tests**.



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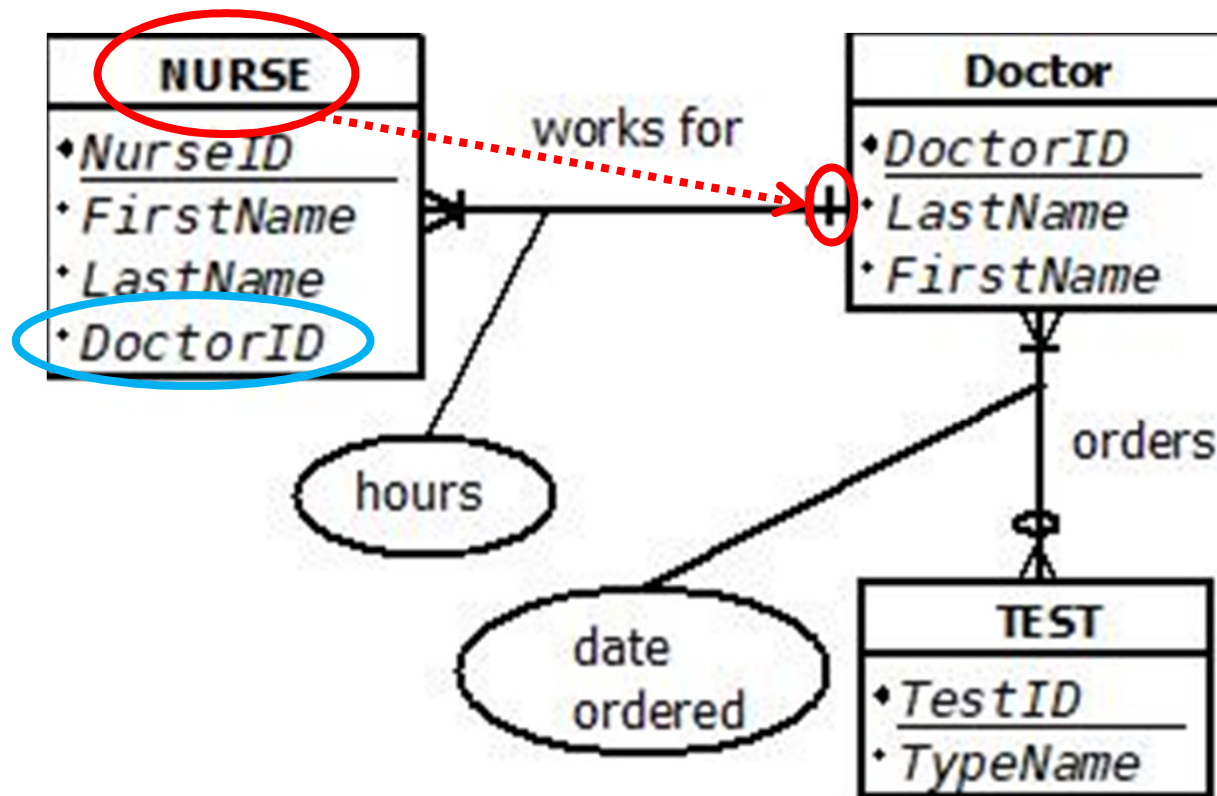
Step 7: Create **Foreign Keys** to form displayed relationships.



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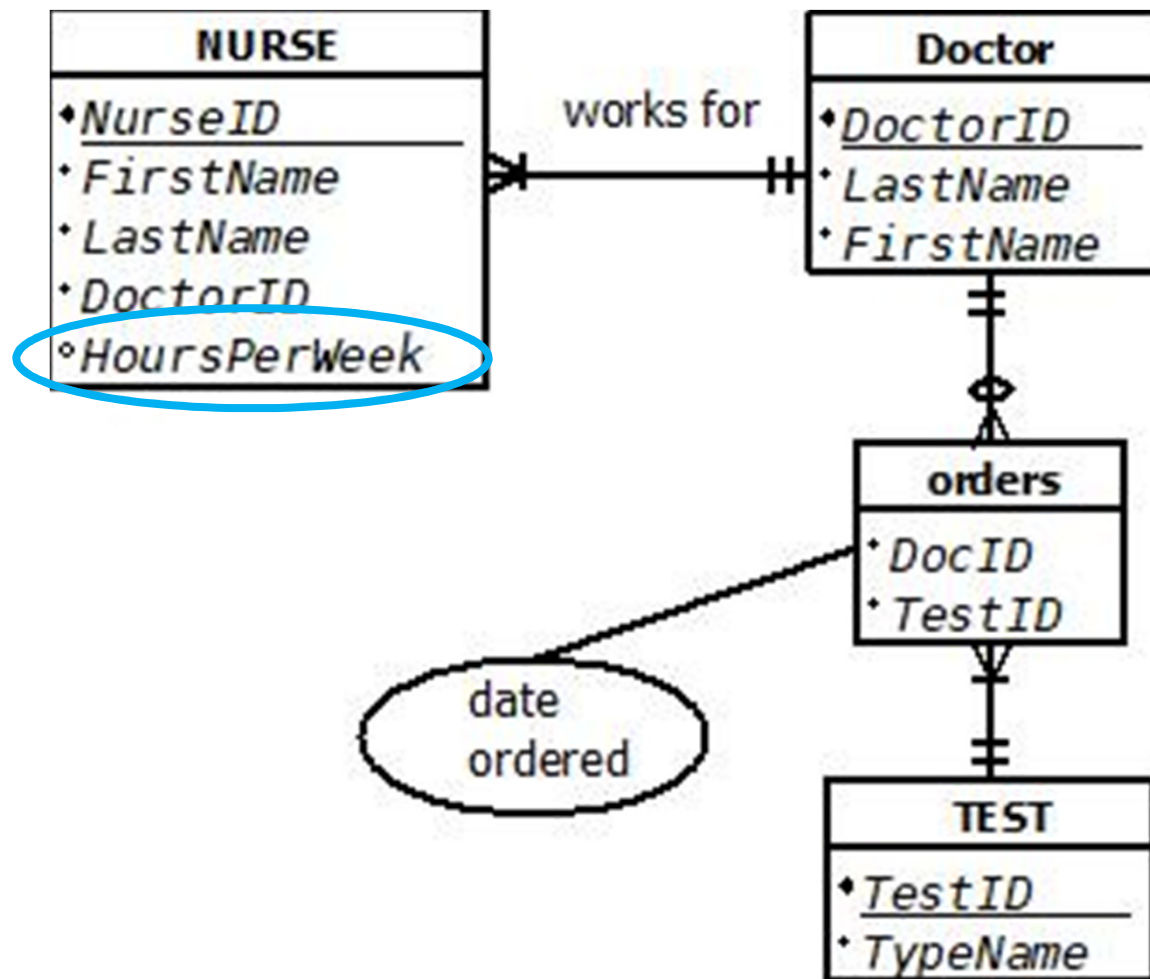
Step 7: Create **Foreign Keys** to form displayed relationships.

(1:N - then the ONE entity must receive the foreign key)



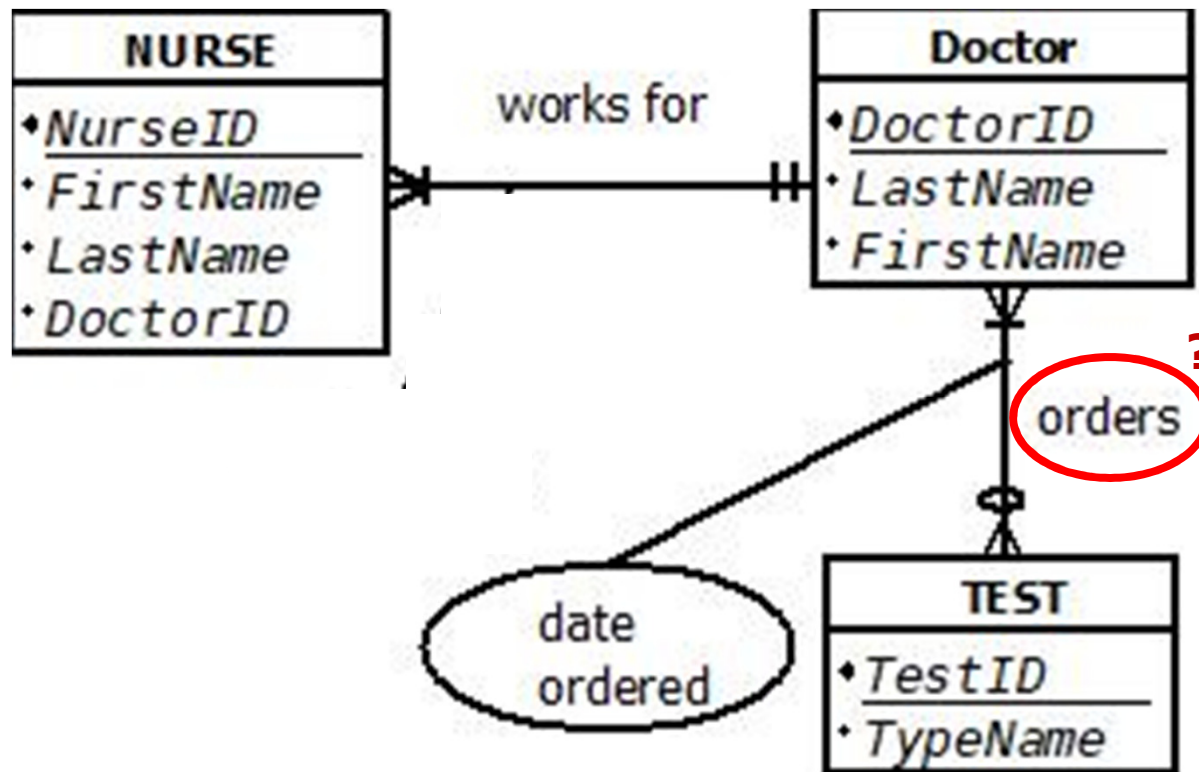
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Step 7: Resolve relationship ATTRIBUTES



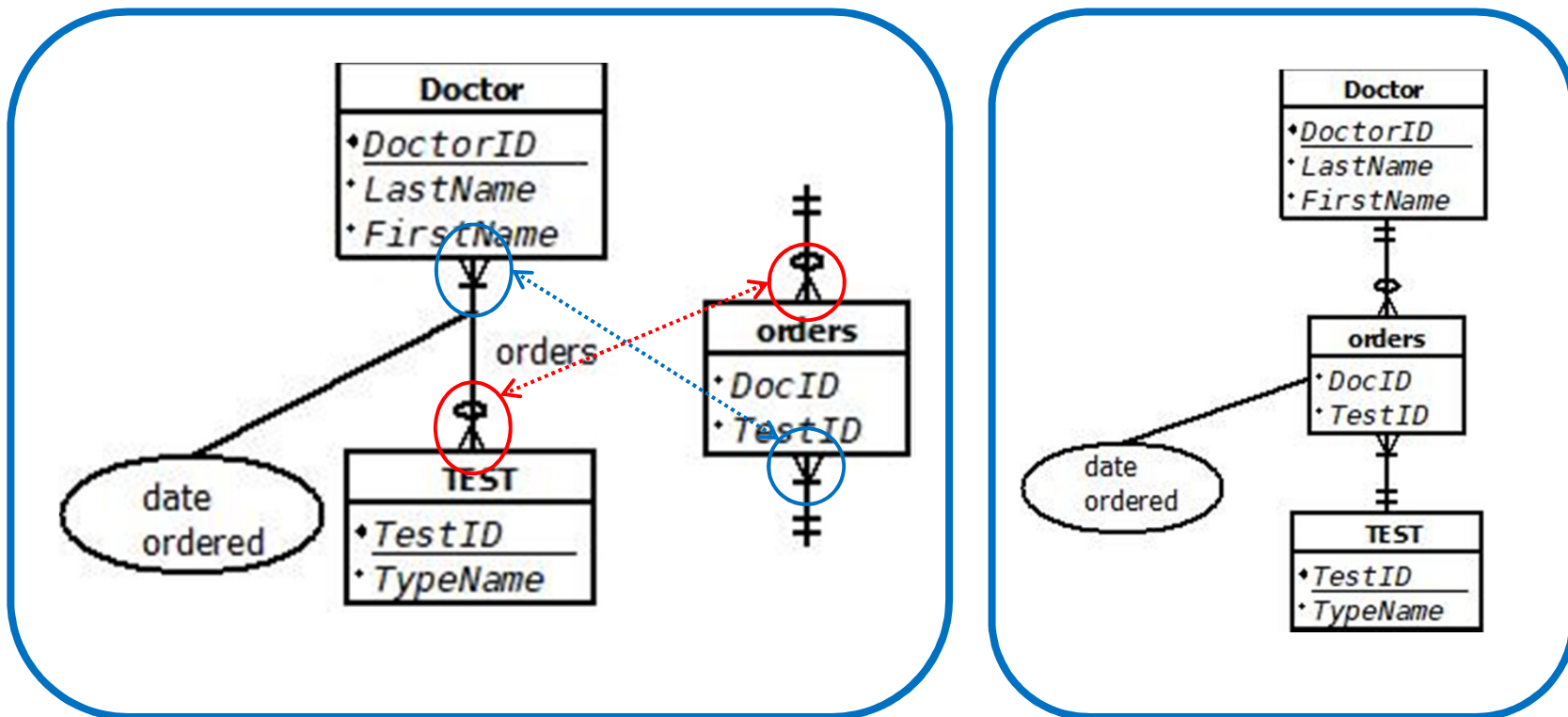
MIS – Database I - ERD

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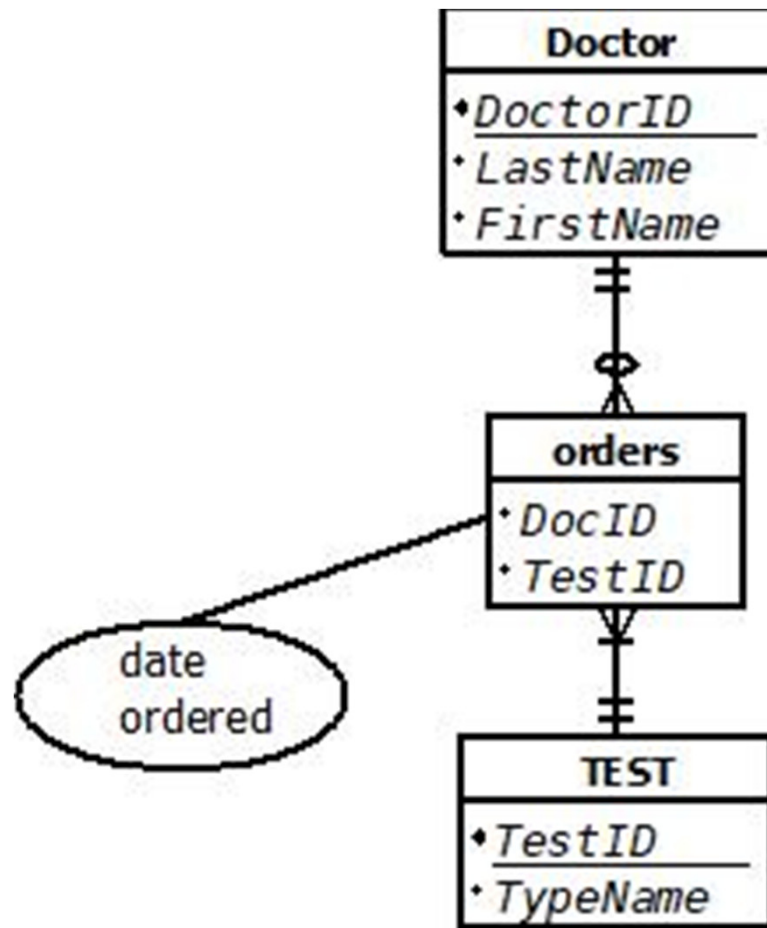
MIS – Database I - ERD

Step 7: Resolve N:M relationships (create connector relationships).



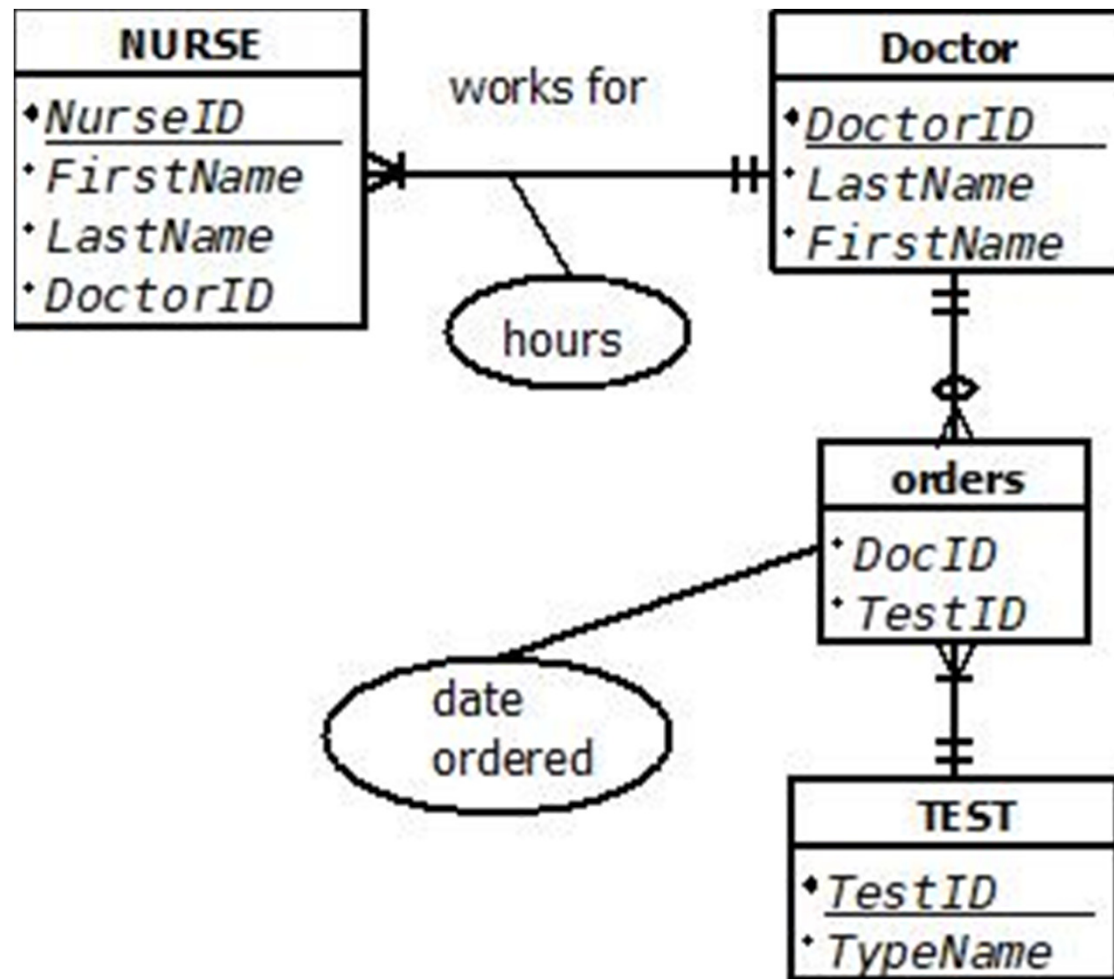
MIS – Database I - ERD

Step 7: Resolve N:M relationships (create connector relationships).



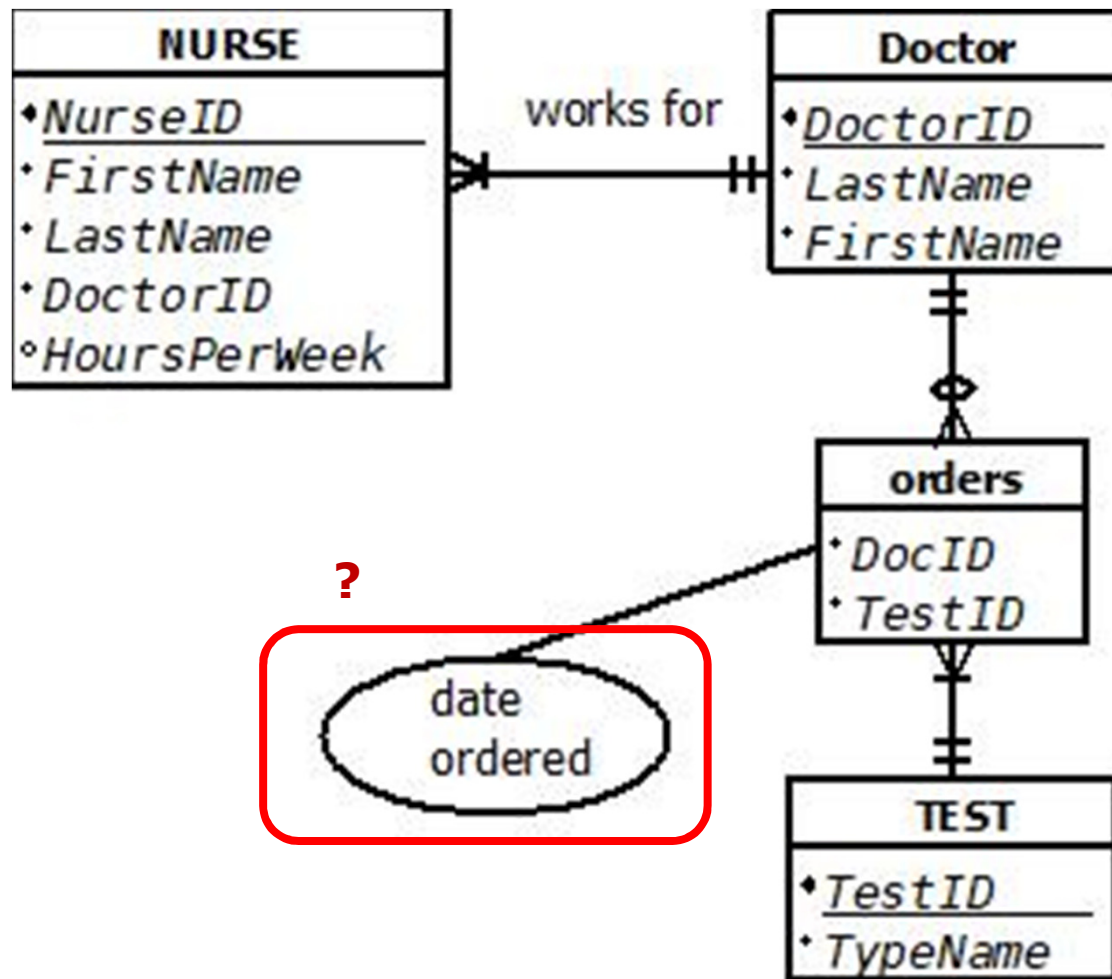
MIS – Database I - ERD

Step 7: Resolve N:M relationships (create connector relationships).



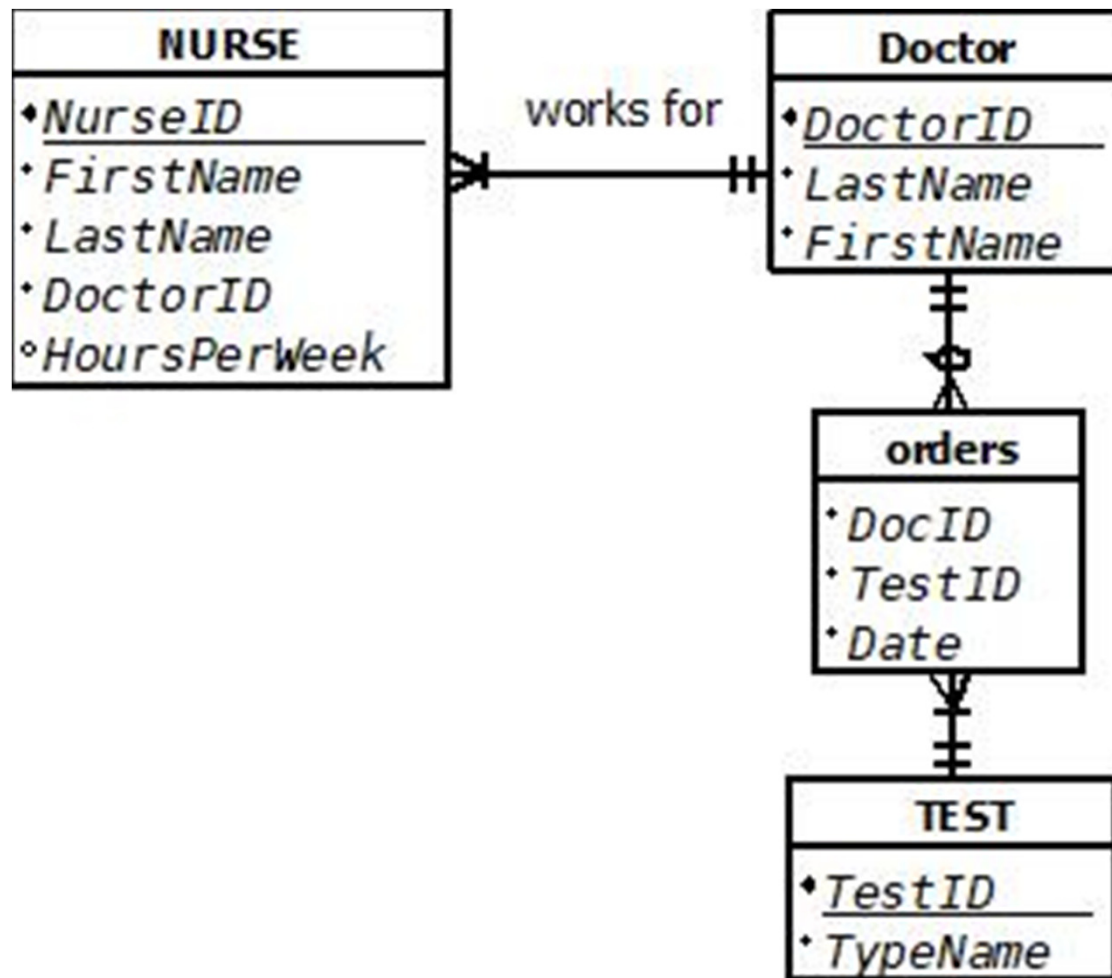
MIS – Database I - ERD

Step 7: Resolve relationship ATTRIBUTES



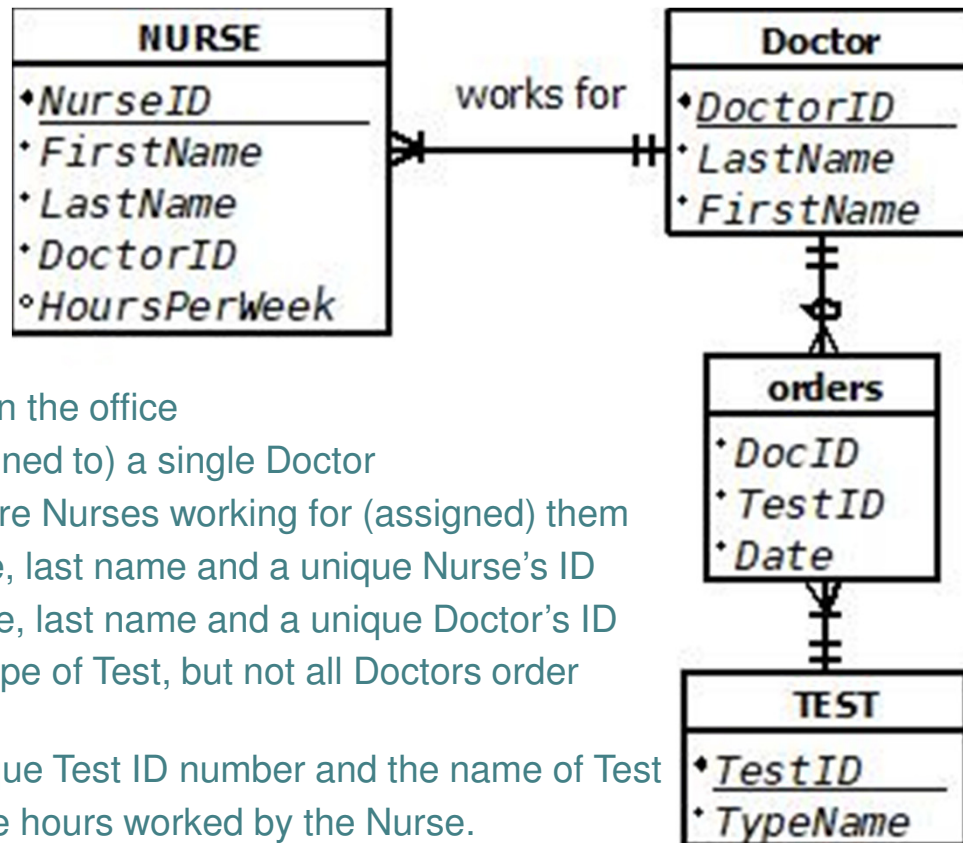
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Step 7: Resolve relationship ATTRIBUTES



MIS – Database I - ERD

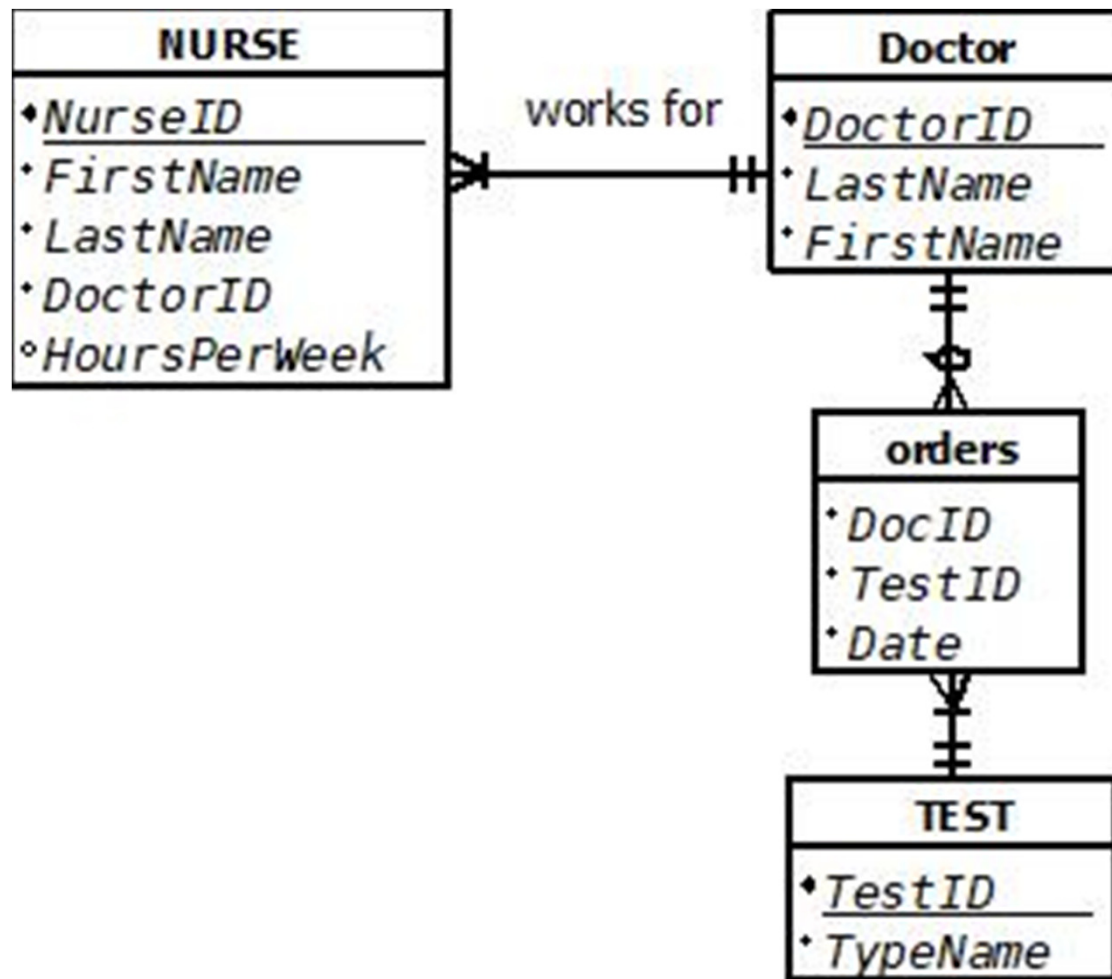
COMPLETED E-R DIAGRAM (ERD)



- In a Doctor's Office
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 - We need to keep track of the date that any Test order was placed

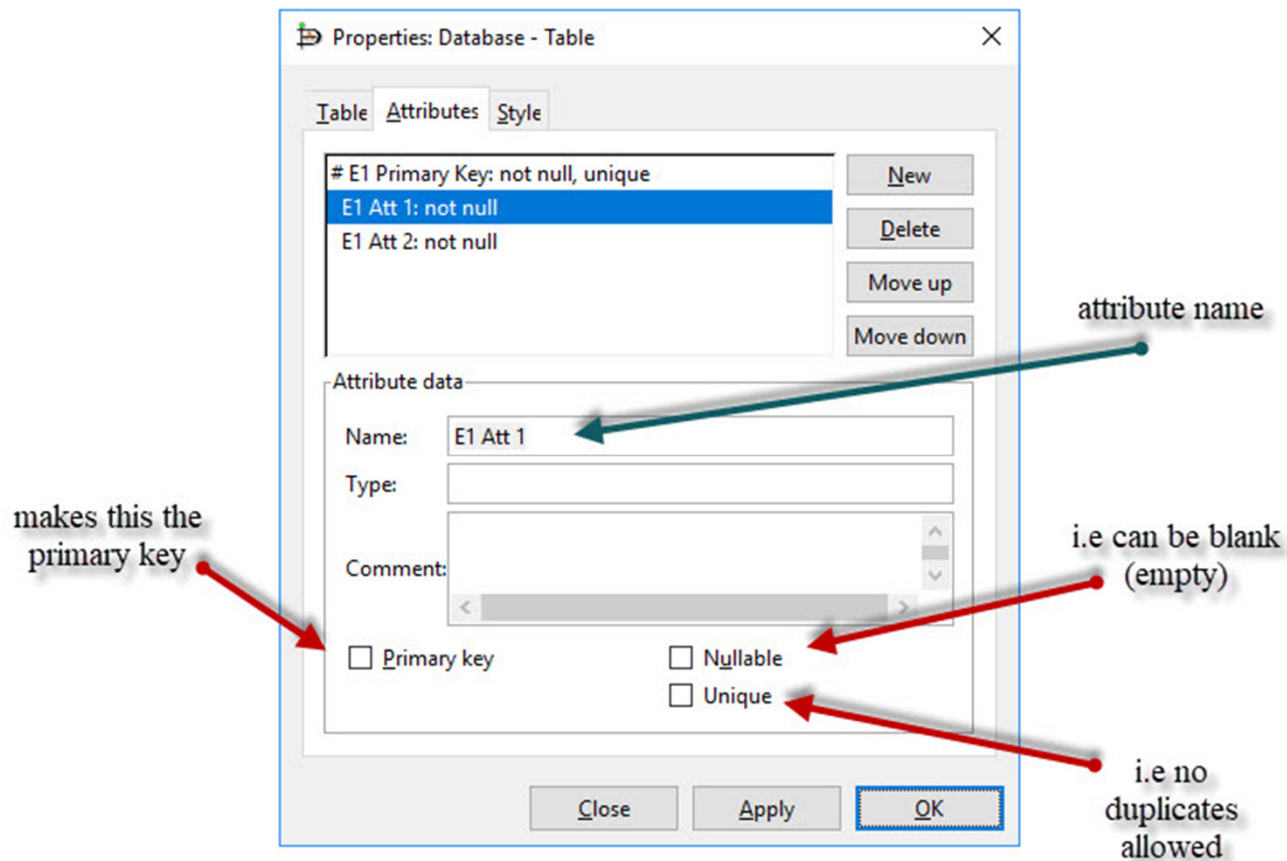
MIS – Database I - ERD

COMPLETED E-R DIAGRAM (ERD)



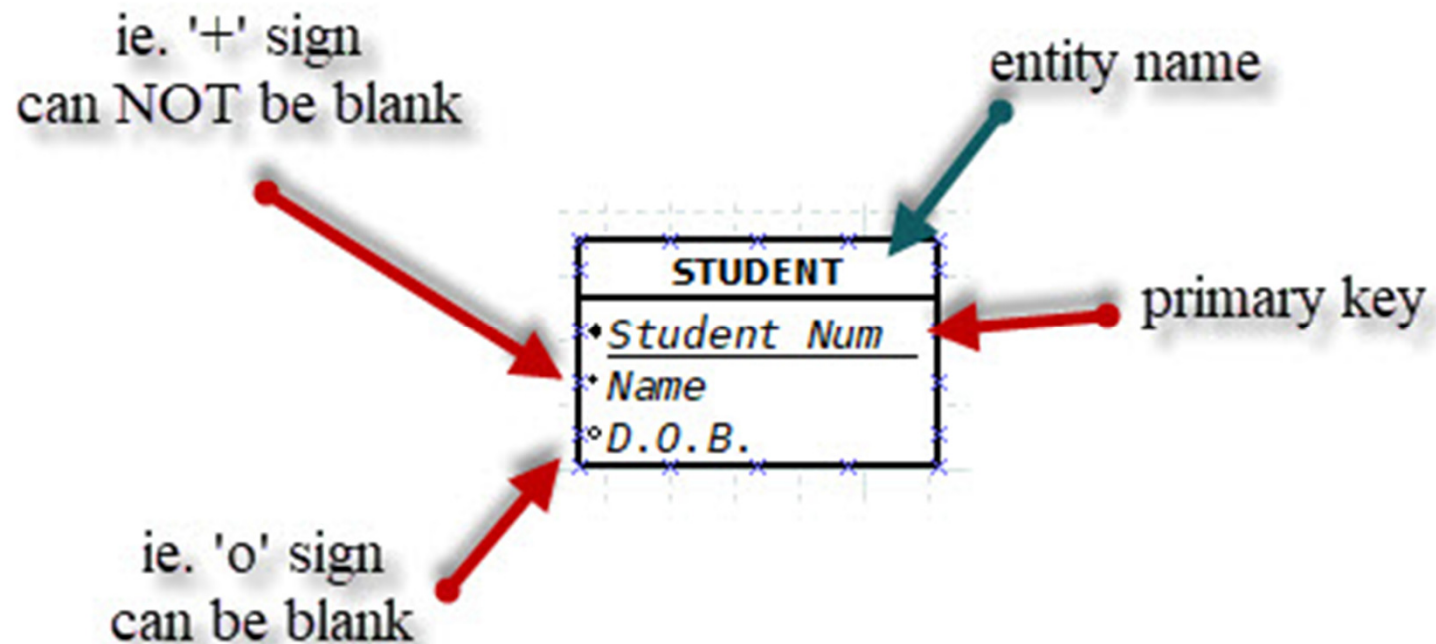
MIS – Database I - ERD

Attributes (DIA.EXE PROGRAM)



MIS – Database I - ERD

Attributes (DIA.EXE PROGRAM)



MIS – Database I - ERD

Attributes

- **USAGE**

PRIMARY KEYS: (always!)

Nullable (**NO**) - can NOT be blank (empty)

Unique (**YES**) - the data can NOT be the repeated

A Primary Key must be filled in and must be unique:

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Attributes

- **USAGE**

- FOREIGN KEYS:**

- Nullable** - based on participation

- MANDATORY: unchecked (**NO**)

- OPTIONAL: checked (**YES**)

- Unique** - based on cardinality

- 1: checked (**YES**)

- MANY : unchecked (**NO**)

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Attributes

- **USAGE**

Nullable: indicates if this field be blank (empty)

checked (yes) - the field can be empty or filled in

unchecked (no) - the field can never be blank

i.e. leaving empty will cause an error

rule of thumb - common sense: must the field have data ?

Example: Student Last Name (generally not Nullable)

Student Date of Birth (generally can be left empty)

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Attributes

- **USAGE**

Unique: indicates if this field can have the same data as other records
checked (yes) - the data in this field can not be duplicated
unchecked (no) - the data can be the repeated
i.e. the same data appears in other records

rule of thumb - usage: must the field have unique data ?

Example: Student Locker Number

if students share lockers then no (unchecked)

if each student has their own locker then yes (checked)