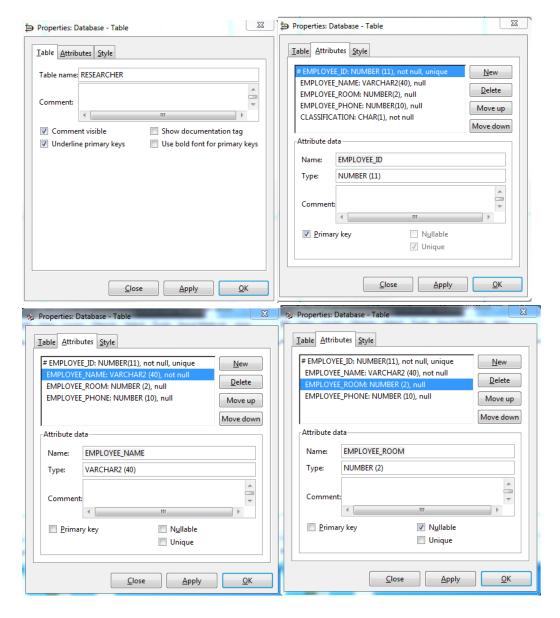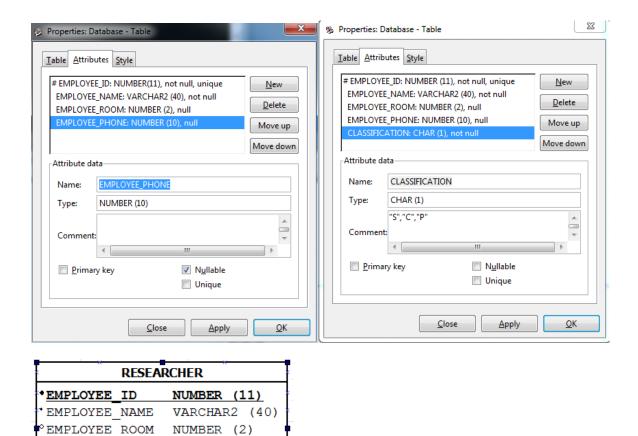Problem 8: Superclass and subclasses

There are a number of researchers in our Cochlear Implant Team. Researchers are mainly composed of supervisors, clinicians, and programmers. Each employee can have only one classification. For all researchers, we store the employee ID, name, office room number, and office phone number.

A supervisor usually supervises several clinicians and/or programmers and some other research staff, but each researcher is supervised by only one supervisor. We would also like to store the supervisor's research interest, the clinician's level, and the programmer's years of experience. The clinician's level is denoted by one of I, II, III, IV, and V.

Please create the superclass as follows:

Properties: Database - Table

Table   Attributes   Style

EMPLOYEE_ID: NUMBER(11), not null, unique
EMPLOYEE_NAME: VARCHAR2 (40), not null
EMPLOYEE_ROOM: NUMBER (2), null
EMPLOYEE_PHONE: NUMBER (10), null

[New] [Delete] [Move up] [Move down]

Attribute data

Name: EMPLOYEE_PHONE

Type: NUMBER (10)

Comment:

☐ Primary key   ☑ Nullable
               ☐ Unique

[Close] [Apply] [OK]

Properties: Database - Table

Table   Attributes   Style

EMPLOYEE_ID: NUMBER (11), not null, unique
EMPLOYEE_NAME: VARCHAR2 (40), not null
EMPLOYEE_ROOM: NUMBER (2), null
EMPLOYEE_PHONE: NUMBER (10), null
CLASSIFICATION: CHAR (1), not null

[New] [Delete] [Move up] [Move down]

Attribute data

Name: CLASSIFICATION

Type: CHAR (1)

"S","C","P"

Comment:

☐ Primary key   ☐ Nullable
               ☐ Unique

[Close] [Apply] [OK]

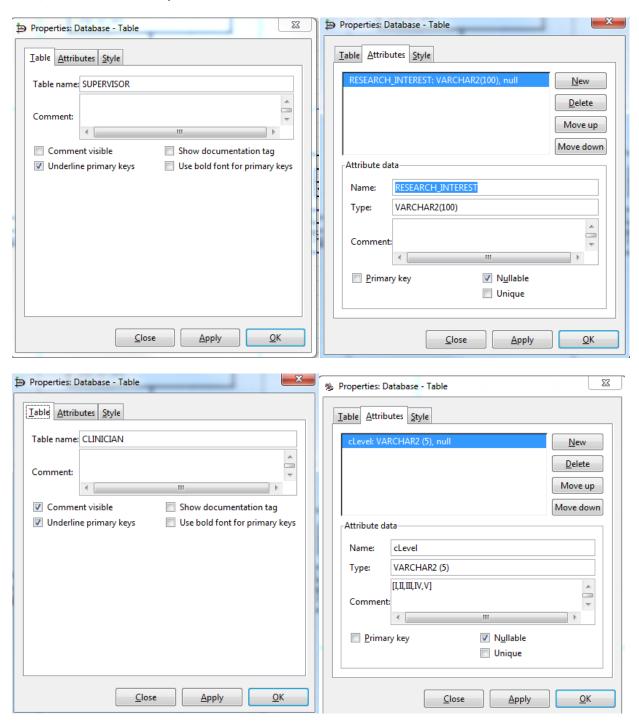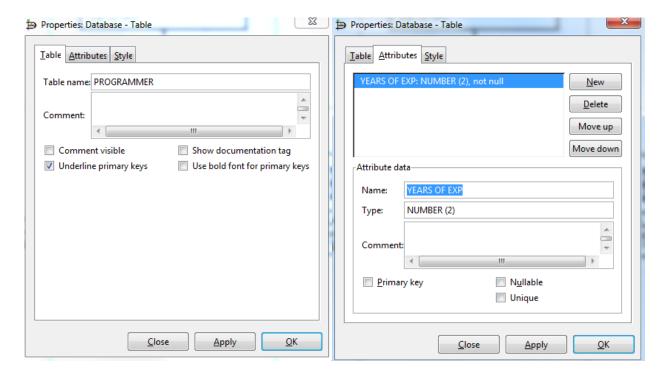| RESEARCHER	
EMPLOYEE_ID	NUMBER (11)
EMPLOYEE_NAME	VARCHAR2 (40)
EMPLOYEE_ROOM	NUMBER (2)
EMPLOYEE_PHONE	NUMBER (10)
CLASSIFICATION	CHAR (1)
"S","C","P"	

Notice how the Classification variable is represented. Since, the problem says "Each employee can have only one classification" this is a disjoint specialization. Therefore, the superclass needs one attribute with multiple values such as S=Supervisor, C=Clinician and P=Programmer.

Next, for the 3 subclasses please do as follows:

Properties: Database - Table

Table | Attributes | Style

Table name: SUPERVISOR

Comment:

☐ Comment visible   ☐ Show documentation tag
☑ Underline primary keys   ☐ Use bold font for primary keys

Close   Apply   OK

Properties: Database - Table

Table | Attributes | Style

RESEARCH_INTEREST: VARCHAR2(100), null

New
Delete
Move up
Move down

Attribute data
Name: RESEARCH_INTEREST
Type: VARCHAR2(100)
Comment:

☐ Primary key   ☑ Nullable
                        ☐ Unique

Close   Apply   OK

Properties: Database - Table

Table | Attributes | Style

Table name: CLINICIAN

Comment:

☑ Comment visible   ☐ Show documentation tag
☑ Underline primary keys   ☐ Use bold font for primary keys

Close   Apply   OK

Properties: Database - Table

Table | Attributes | Style

cLevel: VARCHAR2 (5), null

New
Delete
Move up
Move down

Attribute data
Name: cLevel
Type: VARCHAR2 (5)
Comment: [I,II,III,IV,V]

☐ Primary key   ☑ Nullable
                        ☐ Unique
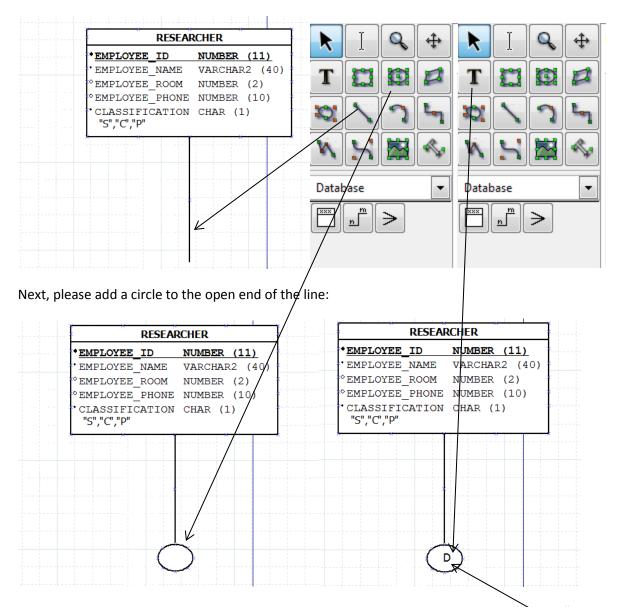
Close   Apply   OK

Now your model has the superclass and all the subclasses. Next, to add the appropriate relationships please do as follows:

First, please draw a line under the Researcher entity:

RESEARCHER

◆EMPLOYEE_ID	NUMBER (11)
*EMPLOYEE_NAME	VARCHAR2 (40)
◦EMPLOYEE_ROOM	NUMBER (2)
◦EMPLOYEE_PHONE	NUMBER (10)
*CLASSIFICATION	CHAR (1)
"S","C","P"	

Database

Database

Next, please add a circle to the open end of the line:

RESEARCHER

◆EMPLOYEE_ID	NUMBER (11)
*EMPLOYEE_NAME	VARCHAR2 (40)
◦EMPLOYEE_ROOM	NUMBER (2)
◦EMPLOYEE_PHONE	NUMBER (10)
*CLASSIFICATION	CHAR (1)
"S","C","P"	

RESEARCHER

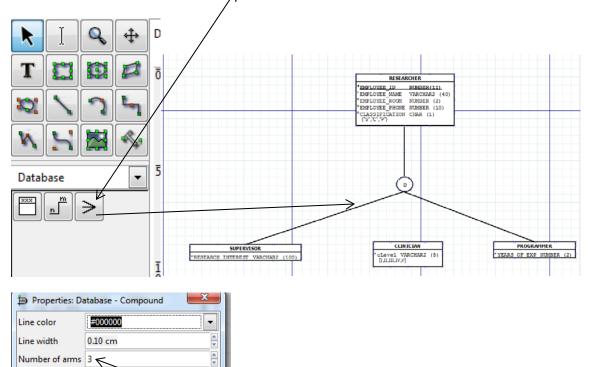|	
◆EMPLOYEE_ID	NUMBER (11)
*EMPLOYEE_NAME	VARCHAR2 (40)
◦EMPLOYEE_ROOM	NUMBER (2)
◦EMPLOYEE_PHONE	NUMBER (10)
*CLASSIFICATION	CHAR (1)
"S","C","P"	

D

Now, please add the text to the circle and write the specialization. In this case, it is "Disjoint".

Now, to complete this relationship between superclass and subclass please do as follows:
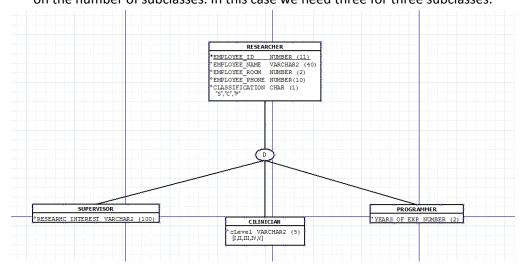
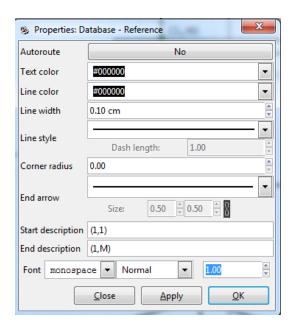Please first click on the Attribute compound icon and then click here.

Next, please click on the Properties of the Attribute Compound and change the Number of arms based on the number of subclasses. In this case we need three for three subclasses.

Next, please draw a relationship between Supervisor and Researcher because the problem says, "A supervisor usually supervises several clinicians and/or programmers and some other research staff, but each researcher is supervised by only one supervisor. Please use the relationship/reference icon for this purpose and change its properties as follows:

Properties: Database - Reference

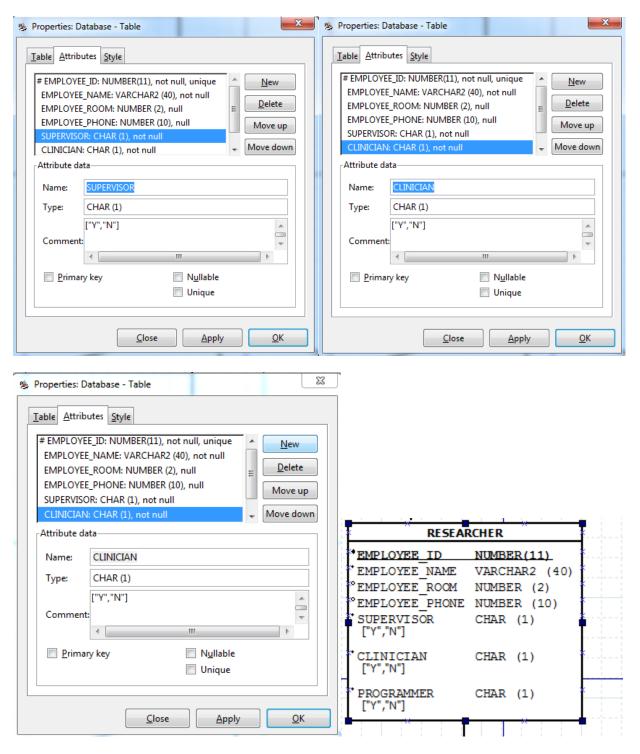|	
Autoroute	No
Text color	#000000
Line color	#000000
Line width	0.10 cm
Line style	
	Dash length: 1.00
Corner radius	0.00
End arrow	
	Size: 0.50 0.50
Start description	(1,1)
End description	(1,M)
Font	monospace Normal 1.00

Close Apply OK

RESEARCHER
* EMPLOYEE_ID   NUMBER (11)
* EMPLOYEE_NAME   VARCHAR2 (40)
° EMPLOYEE_ROOM   NUMBER (2)
° EMPLOYEE_PHONE NUMBER(10)
° CLASSIFICATION CHAR (1)
   "S","C","P"

1M

D

11

SUPERVISOR
° RESEARHC_INTEREST VARCHAR2 (100)

CILINICIAN
* cLevel VARCHAR2 (5)
   [I,II,III,IV,V]

PROGRAMMER
* YEARS_OF_EXP NUMBER (2)

Another scenario: If the problem said "Each employee can have one or more classification" then that would have been an overlapping specialization. In this case the discriminator attribute is treated as a composite attribute. Therefore, you would have to represent your superclass as follows:

Properties: Database - Table (1)

Table | Attributes | Style

```
# EMPLOYEE_ID: NUMBER(11), not null, unique
  EMPLOYEE_NAME: VARCHAR2 (40), not null
  EMPLOYEE_ROOM: NUMBER (2), null
  EMPLOYEE_PHONE: NUMBER (10), null
  SUPERVISOR: CHAR (1), not null
  CLINICIAN: CHAR (1), not null
```

New | Delete | Move up | Move down

Attribute data

Name: SUPERVISOR
Type: CHAR (1)
Comment: ["Y","N"]

☐ Primary key   ☐ Nullable
                 ☐ Unique

Close | Apply | OK

Properties: Database - Table (2)

Table | Attributes | Style

```
# EMPLOYEE_ID: NUMBER(11), not null, unique
  EMPLOYEE_NAME: VARCHAR2 (40), not null
  EMPLOYEE_ROOM: NUMBER (2), null
  EMPLOYEE_PHONE: NUMBER (10), null
  SUPERVISOR: CHAR (1), not null
  CLINICIAN: CHAR (1), not null
```

New | Delete | Move up | Move down

Attribute data

Name: CLINICIAN
Type: CHAR (1)
Comment: ["Y","N"]

☐ Primary key   ☐ Nullable
                 ☐ Unique

Close | Apply | OK

Properties: Database - Table (3)

Table | Attributes | Style

```
# EMPLOYEE_ID: NUMBER(11), not null, unique
  EMPLOYEE_NAME: VARCHAR2 (40), not null
  EMPLOYEE_ROOM: NUMBER (2), null
  EMPLOYEE_PHONE: NUMBER (10), null
  SUPERVISOR: CHAR (1), not null
  CLINICIAN: CHAR (1), not null
```

New | Delete | Move up | Move down

Attribute data

Name: CLINICIAN
Type: CHAR (1)
Comment: ["Y","N"]

☐ Primary key   ☐ Nullable
                 ☐ Unique

Close | Apply | OK

RESEARCHER

```
EMPLOYEE_ID        NUMBER(11)
EMPLOYEE_NAME      VARCHAR2 (40)
EMPLOYEE_ROOM      NUMBER (2)
EMPLOYEE_PHONE     NUMBER (10)
SUPERVISOR         CHAR (1)
  ["Y","N"]

CLINICIAN          CHAR (1)
  ["Y","N"]

PROGRAMMER         CHAR (1)
  ["Y","N"]
```

Superclass always hold the shared attributes between all the subclasses but subclasses always hold atleast 1 non-unique attribute specific to that subclass. In case of mandatory Overlapping or Disjoint specializations; please draw double lines before the D/O circle and for optional Overlapping or Disjoint specializations; please draw single line before the D/O circle in your model.

Please use the following notations when mentioning attributes and values:

a) Composite attribute such as Name or CLASSIFICATION under an overlap condition: () Round brackets
b) Multivalued attribute such as phone number: {} Curly brackets
c) Pre-defined value such as Clinician level: [] Square brackets
d) Discriminator attribute such as CLASSIFICATION under a disjoint condition: No brackets

Hope this tutorial was helpful. In case of any questions or comments, please email me.