



# E/R Exercises

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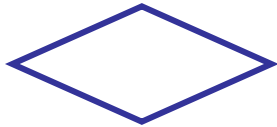


# E/R Basic Components

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Entity set



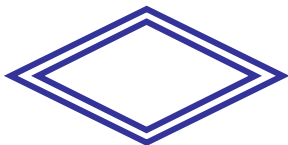
Relationship set



Attribute

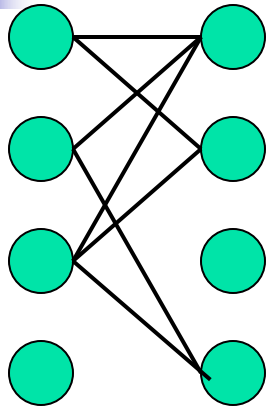


Weak entity set

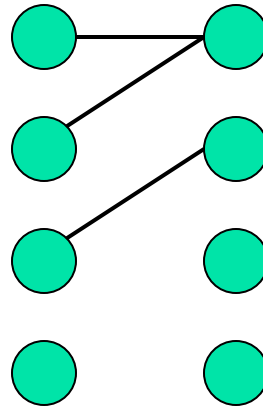


Weak relationship set

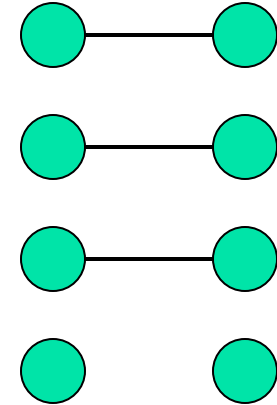
# Multiplicity of Relationships



Many-many



Many-one

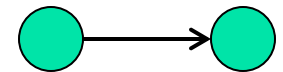


One-one

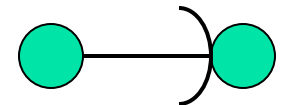
## Representation of Many-One

- E/R: arrow pointing to "one."

- Sharp arrow = "at most one"



- Rounded arrow = "exactly one"



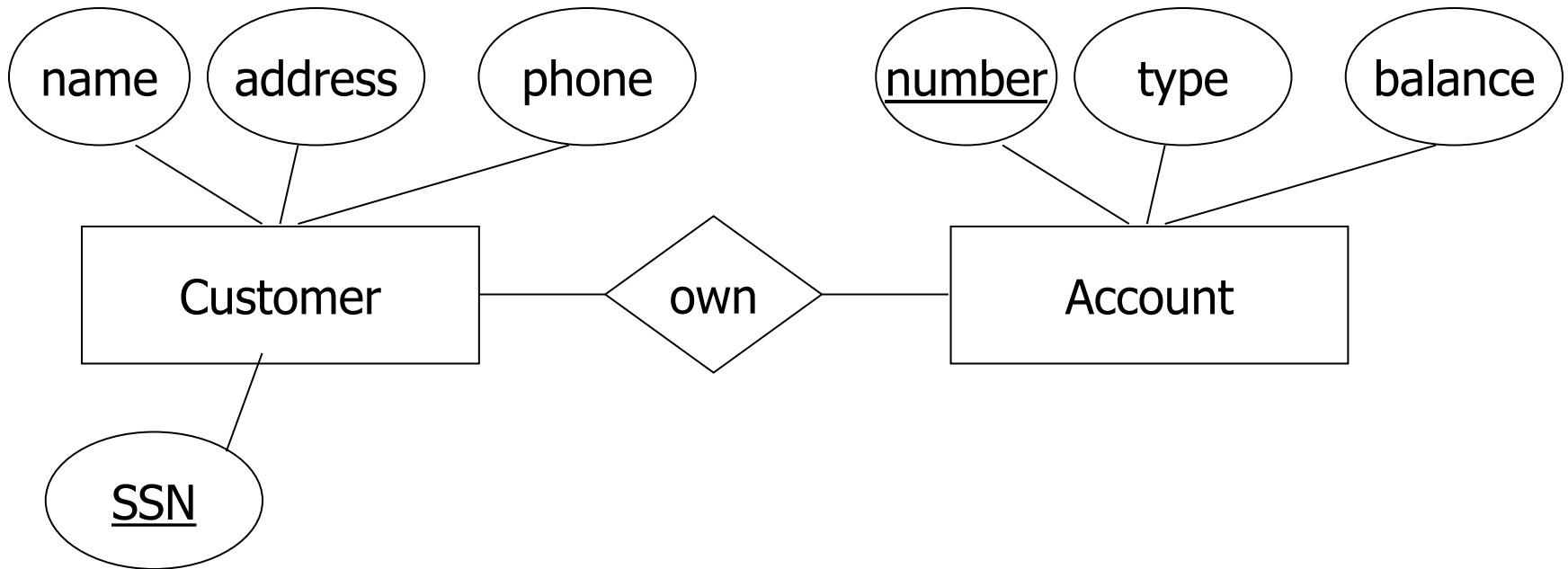


# Exercise #1 - 1

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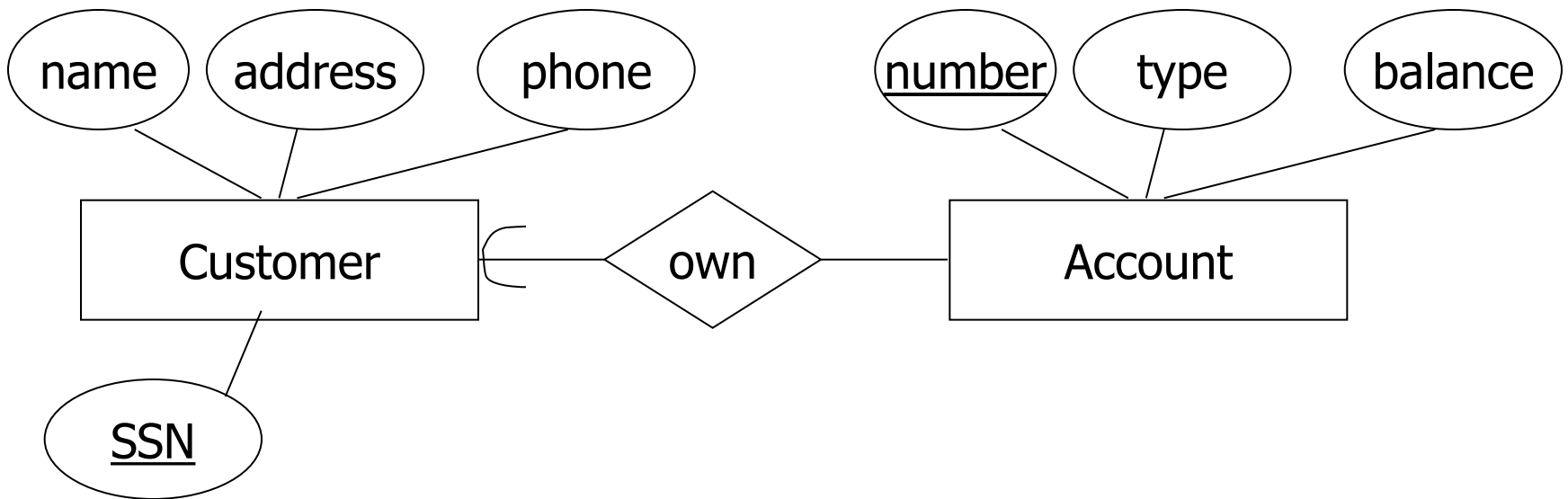
- Draw an **E/R diagram** to model a **database for a bank** including information about customers and their accounts.
  - Information about **customer** includes name, address, phone, and social security number.
  - **Accounts** have numbers, type (saving, checking), and balances.
  - An **account** can be owned by several **customers**, and a **customer** can have multiple **accounts**.

# Exercise #1 - 2



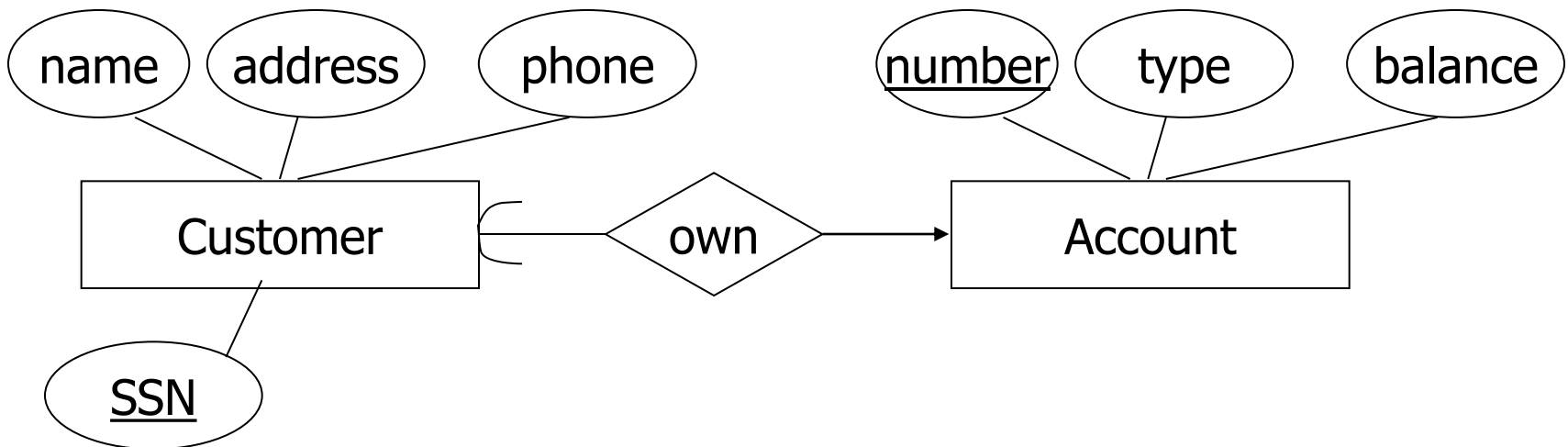
# Exercise #2

Change your design so that **an account can have exactly one customer**



# Exercise #3

Further change your design so a customer can have at most one account



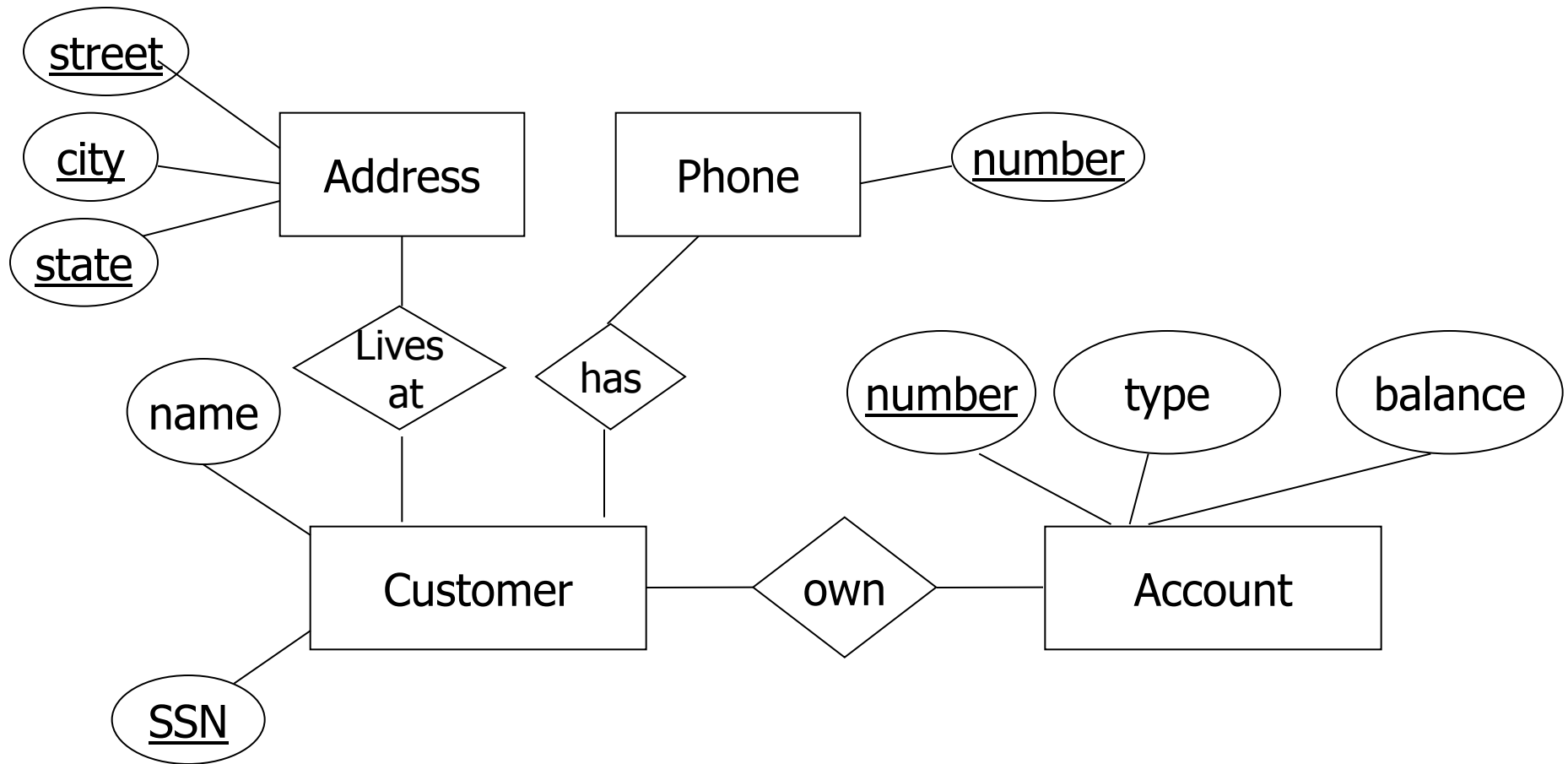


# Exercise #4 - 1

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- Change your original design so that a customer can have a set of addresses (street, city, state) and a set of phones.
- Remember that we do not allow non-atomic types for attributes.

# Exercise #4 - 2



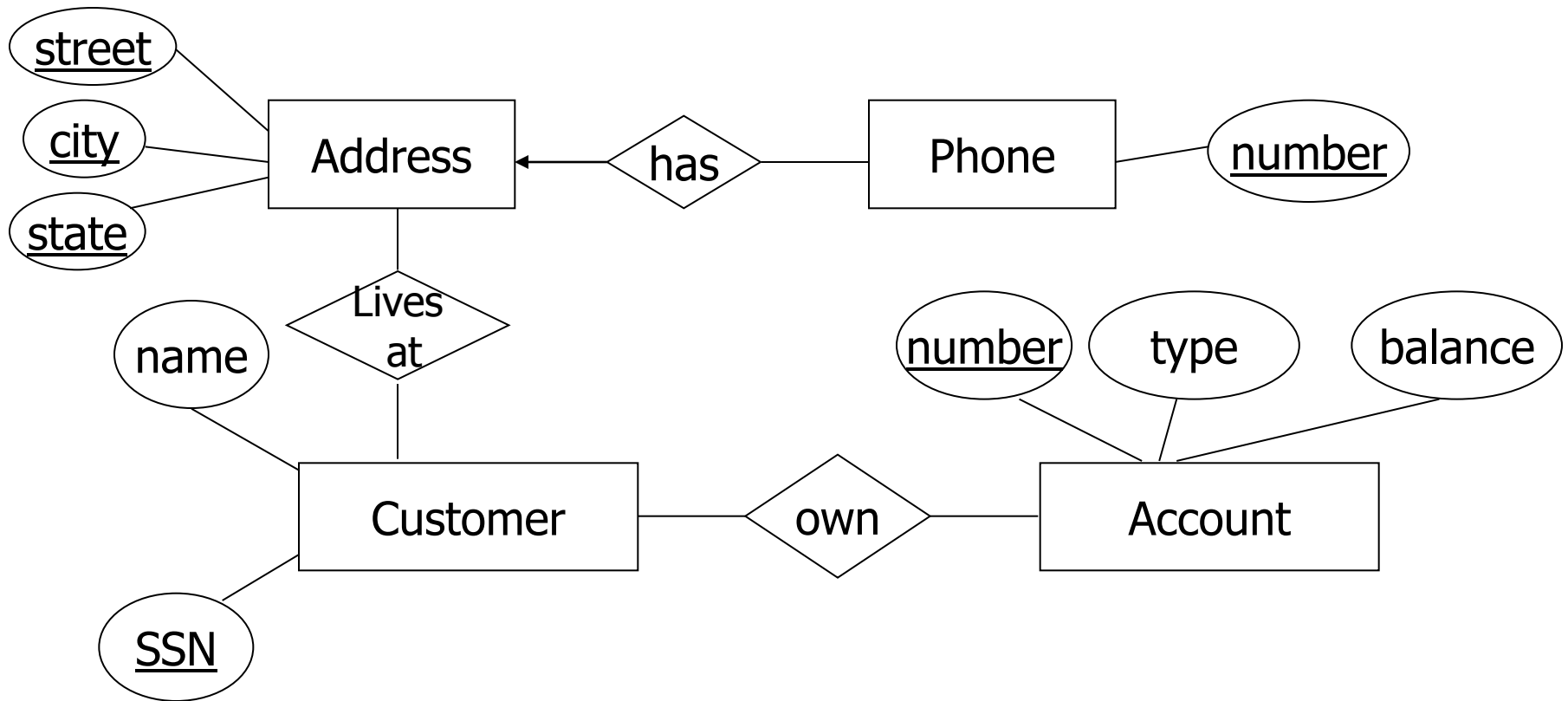


# Exercise #5 - 1

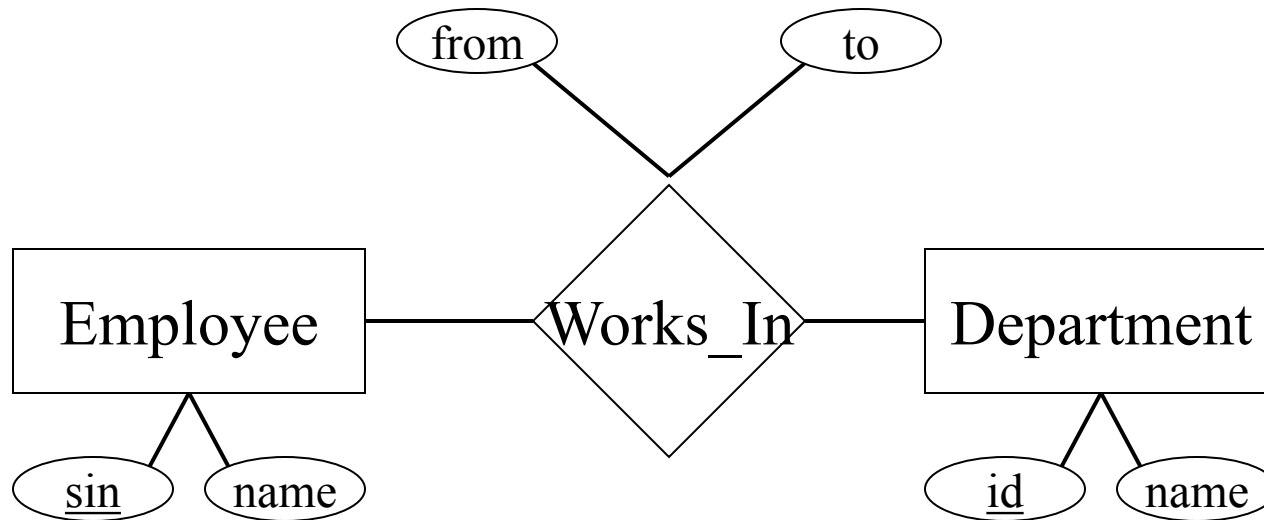
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- Further change your original design so that a customer can have a set of addresses. Also, at each address, there is a set of phones.

# Exercise #5 - 2

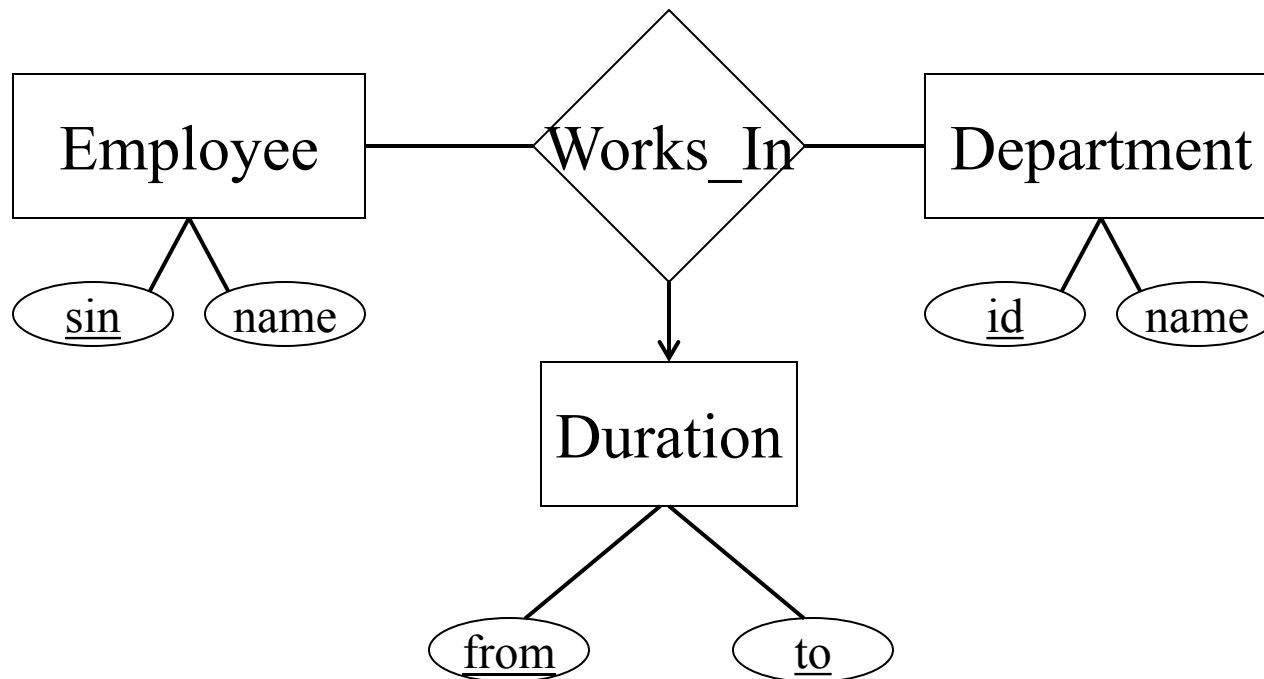


# Exercise #6

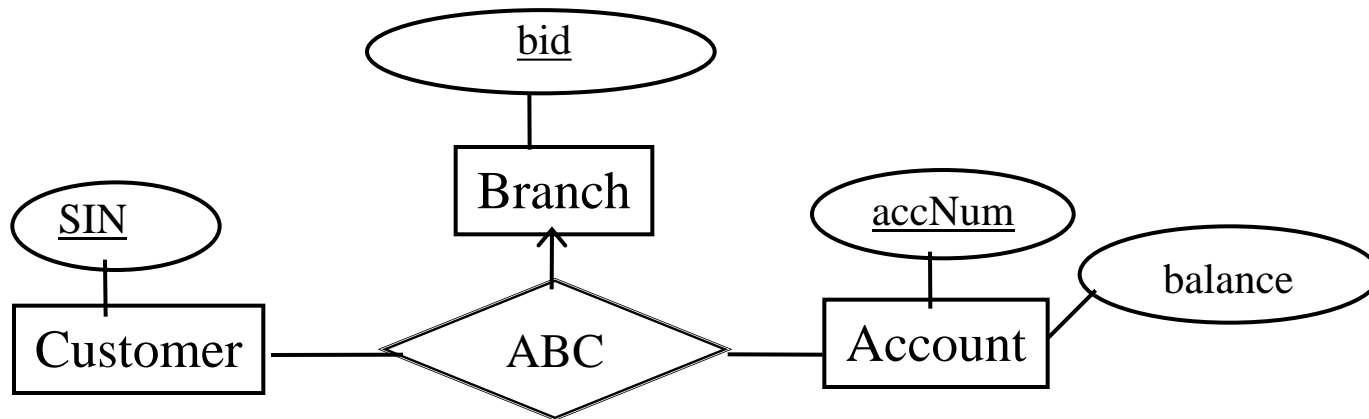


- Convert the above E/R diagram so that the relationship Works\_In does not have any attribute.

# Solution #6

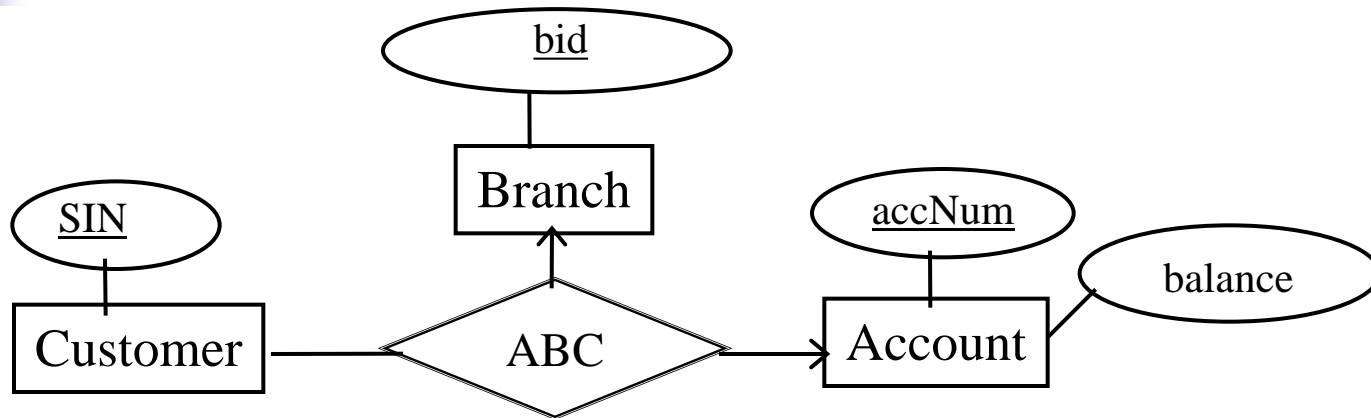


# Multi-way Relationships – 1



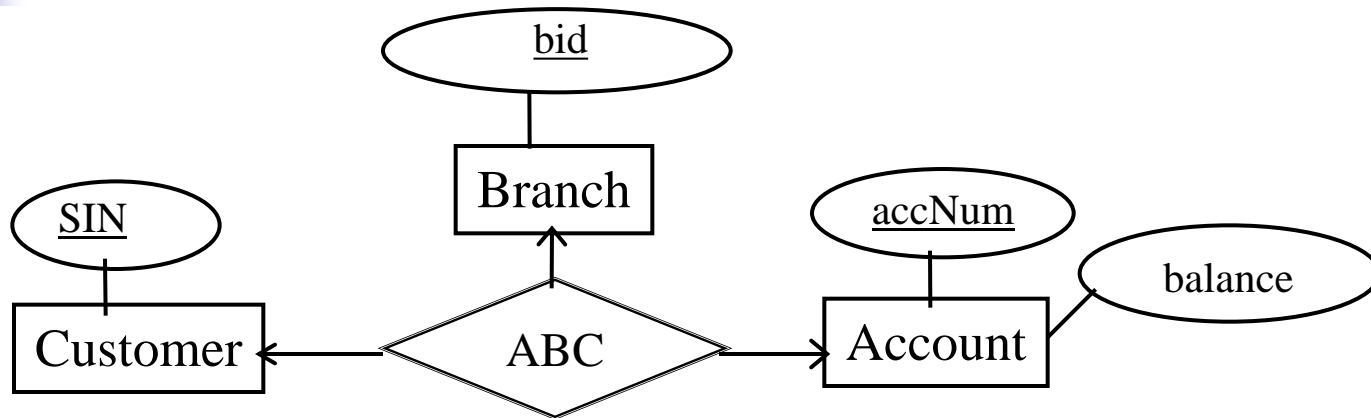
- Many-to-many-to-1 relationship
- Each (Customer, Account) pair is related to a single Branch

# Multi-way Relationships – 2



- Many-to-1-to-1 relationship
- Each (Customer, Branch) pair is related to a single Account
- Each (Customer, Account) pair is related to a single Branch

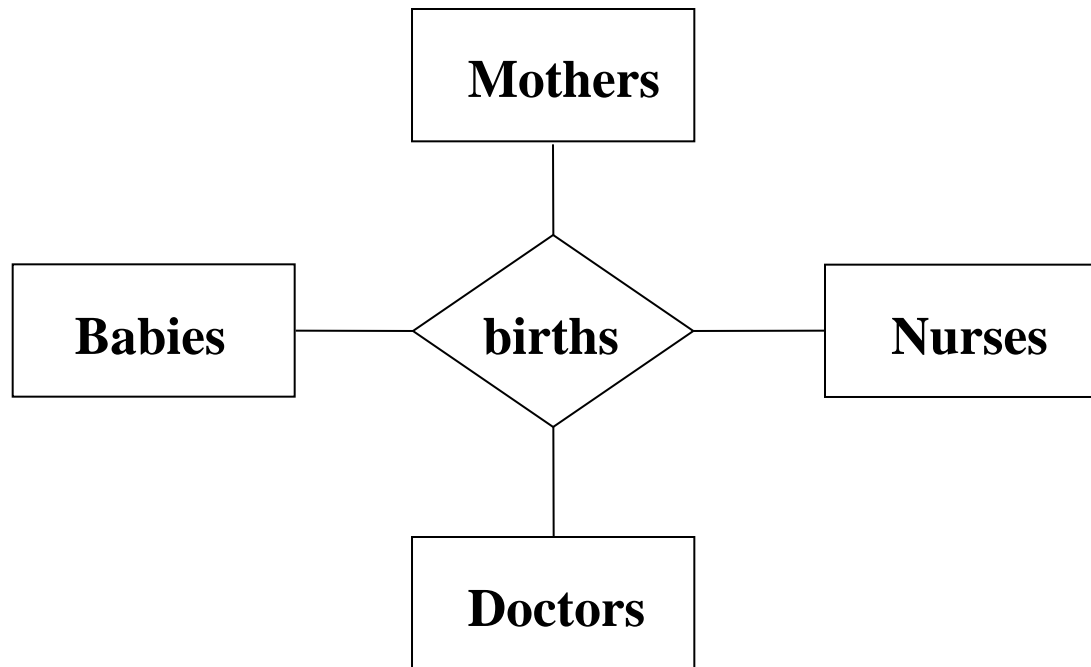
# Multi-way Relationships – 3



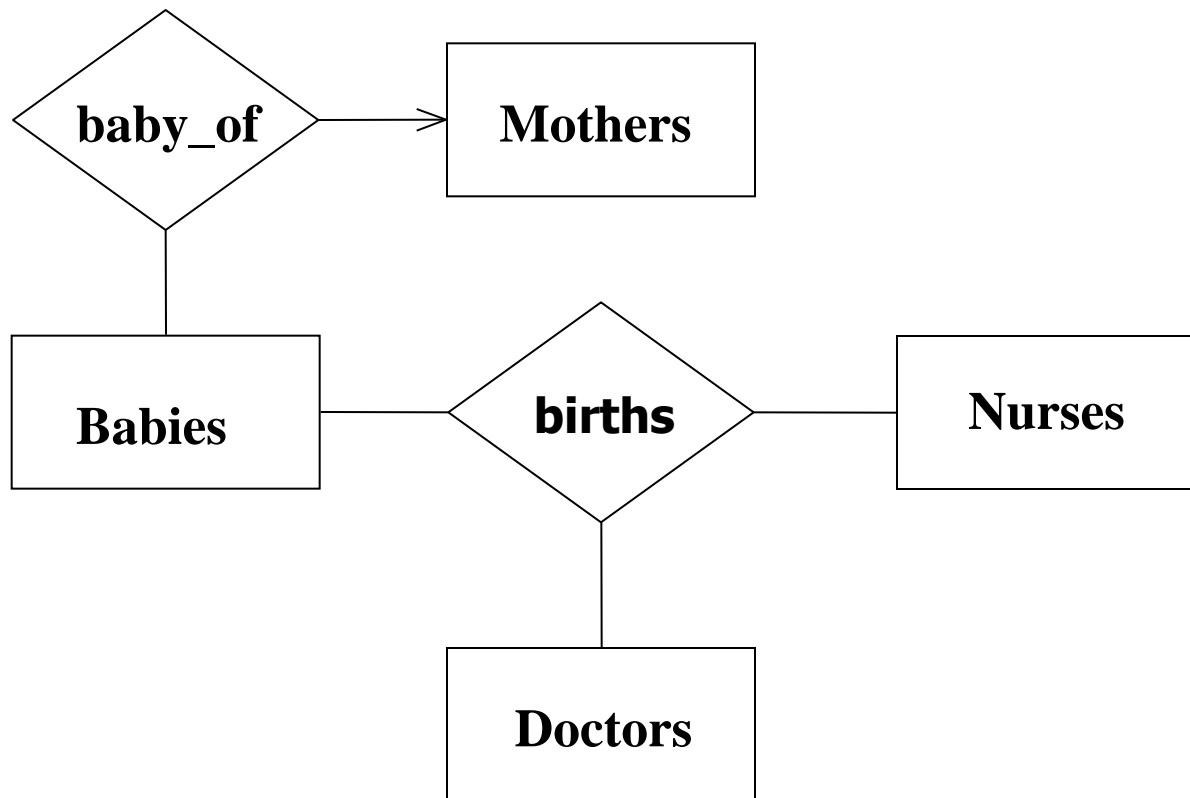
- 1-to-1-to-1 relationship
- Each (Customer, Branch) pair is related to a single Account
- Each (Customer, Account) pair is related to a single Branch
- Each (Branch, Account) pair is related to a single Customer

# Exercise #7

Change this E/R diagram so that for every baby there is a unique mother.

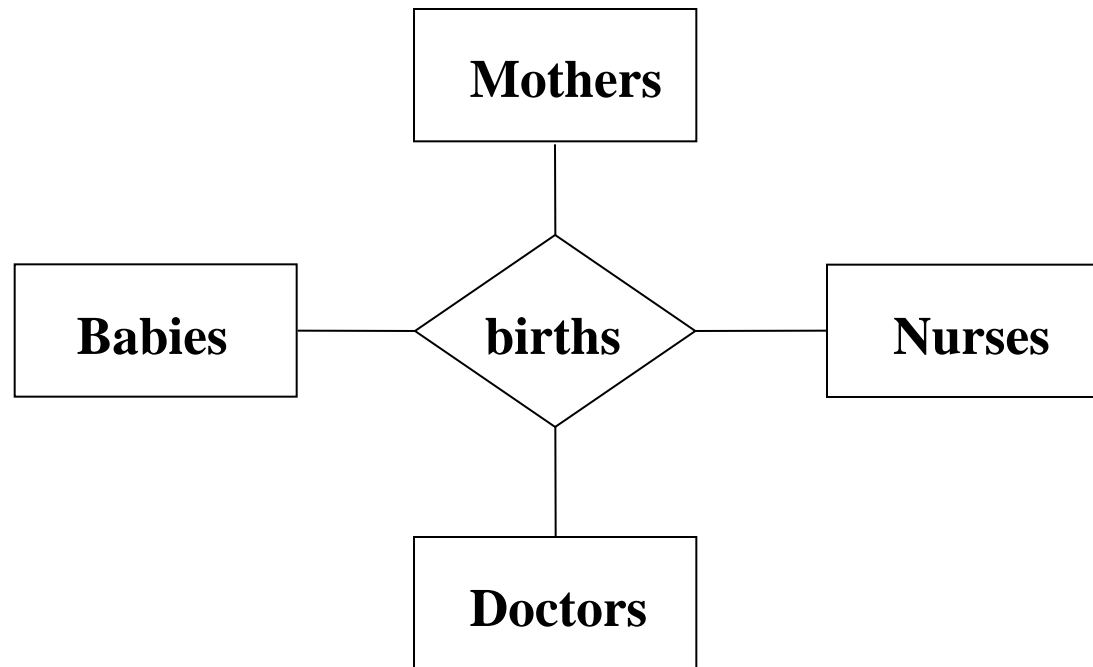


# Solution #7

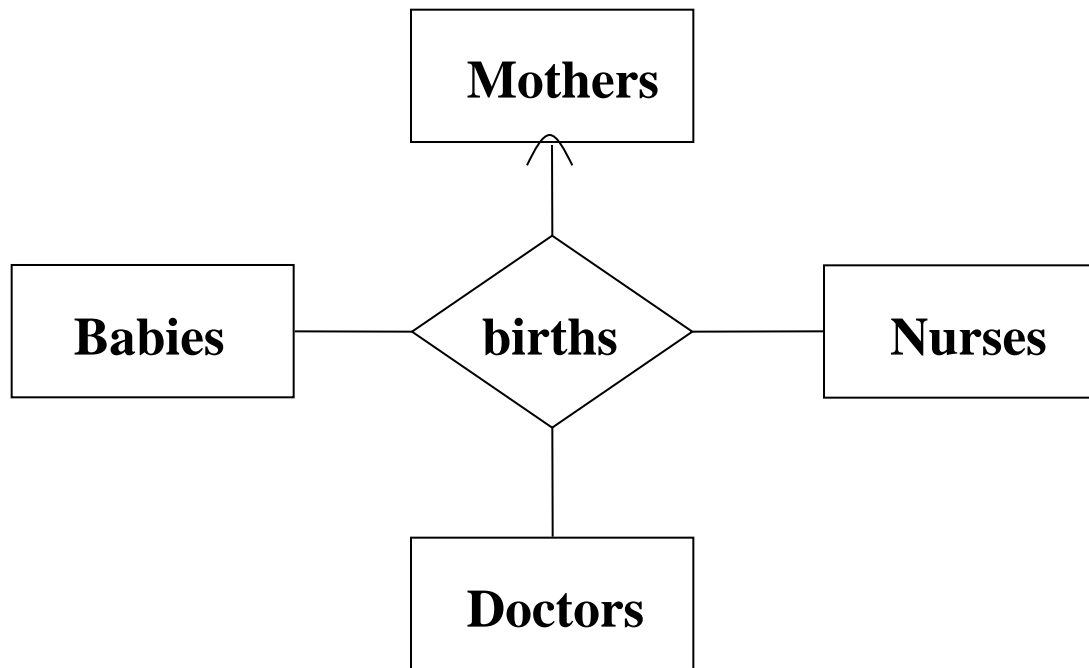


# Exercise #8

Change this E/R diagram so that for every combination of baby, Nurse, and doctor there is a unique mother.

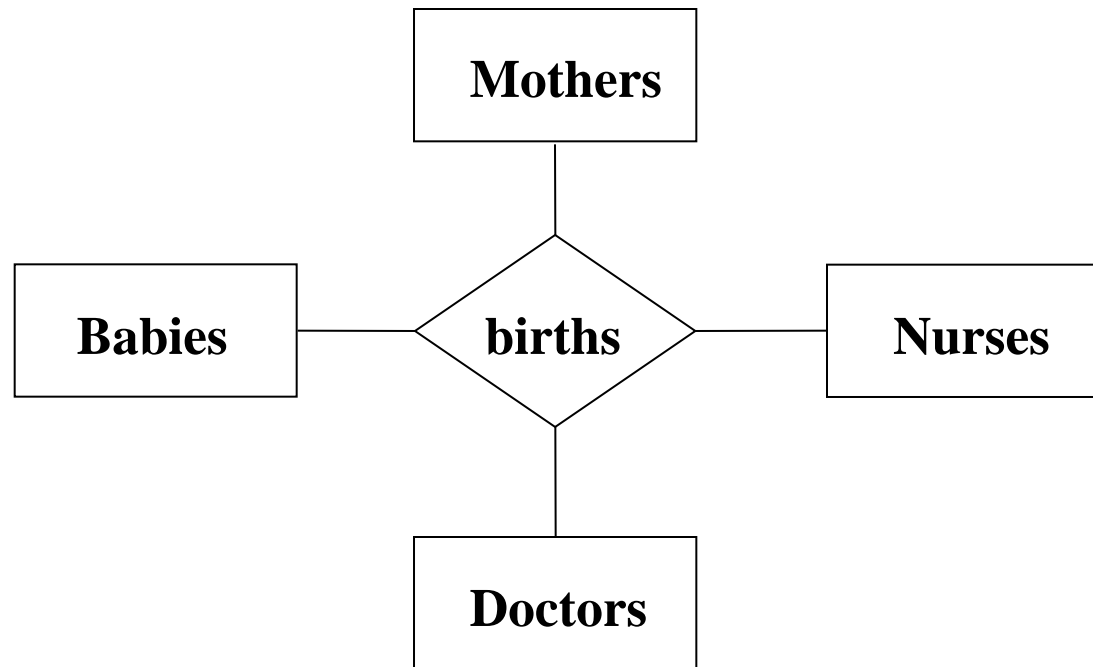


# Solution #8

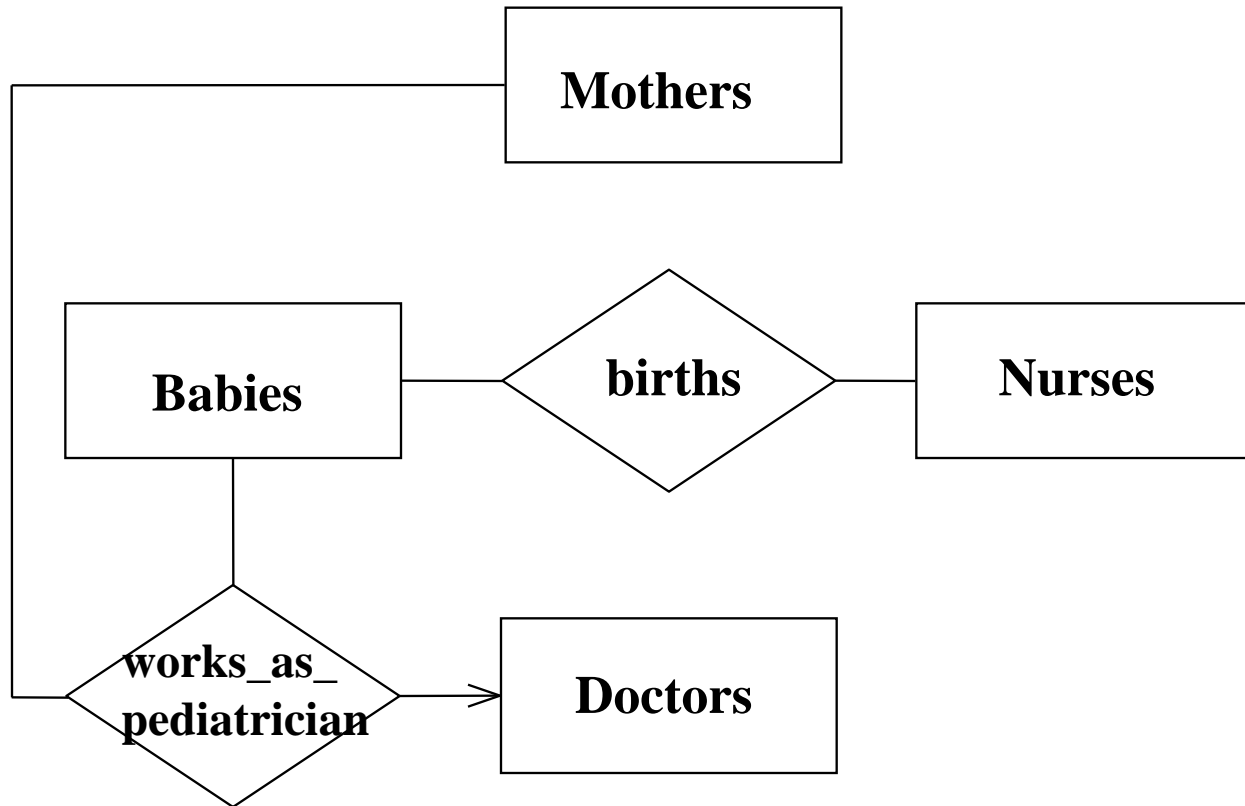


# Exercise #9

Change this E/R diagram so that for every combination of a baby and a mother, there is a unique doctor.

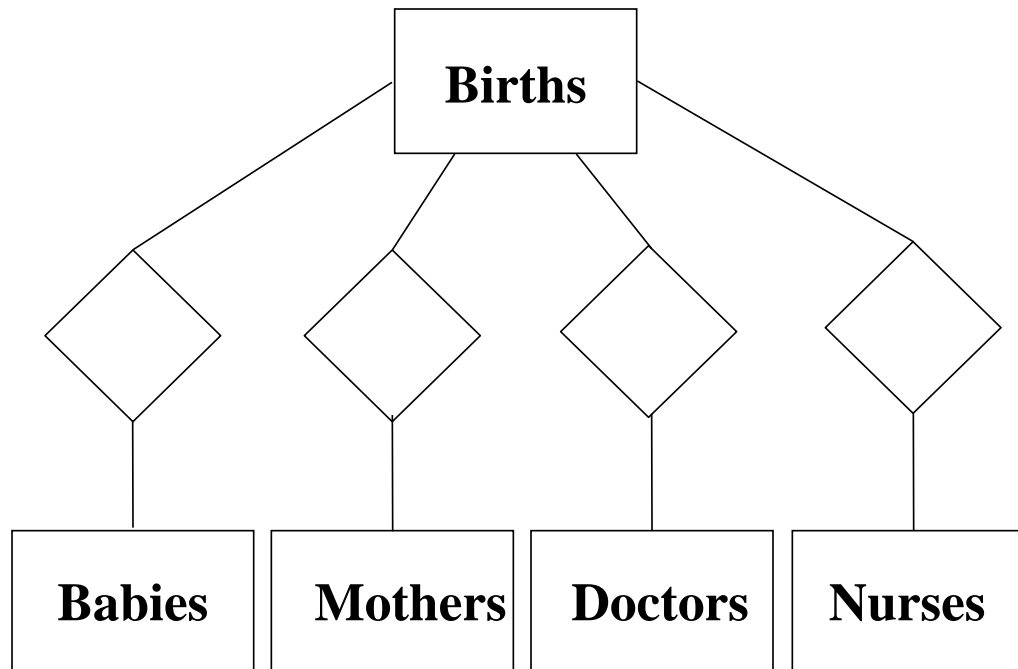


# Solution #9

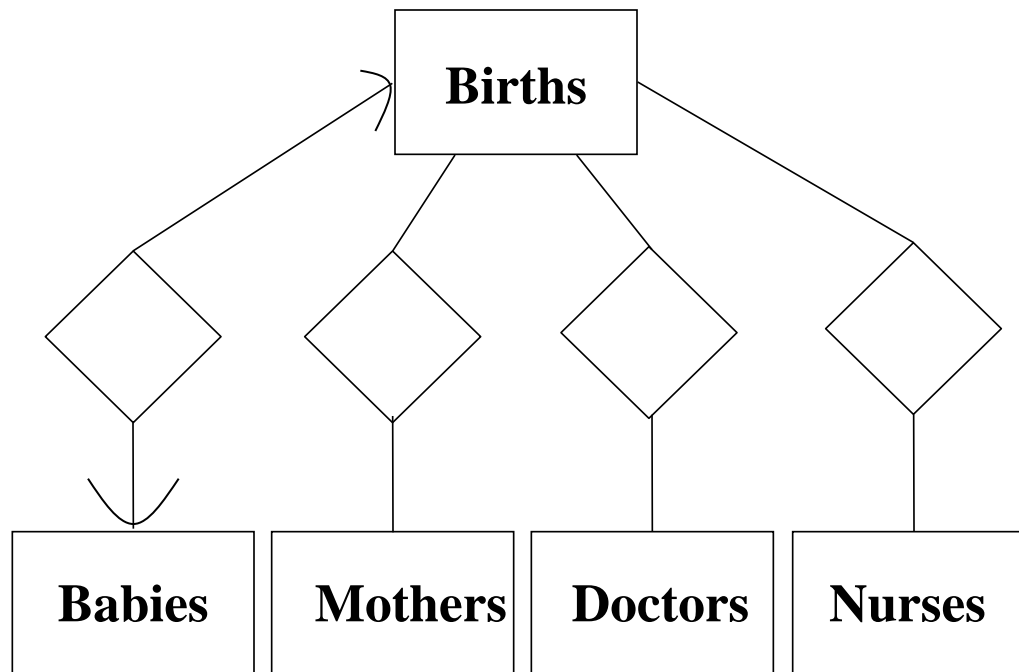


# Exercise #10

Change this E/R diagram so that every baby is the result of a unique birth and every birth is of a unique baby

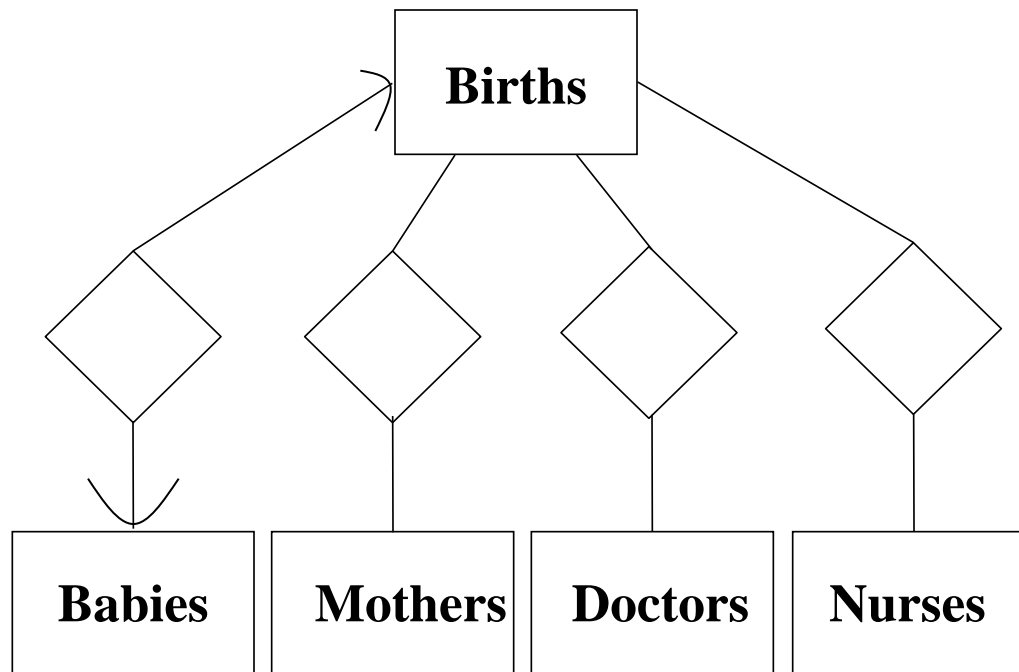


# Solution #10

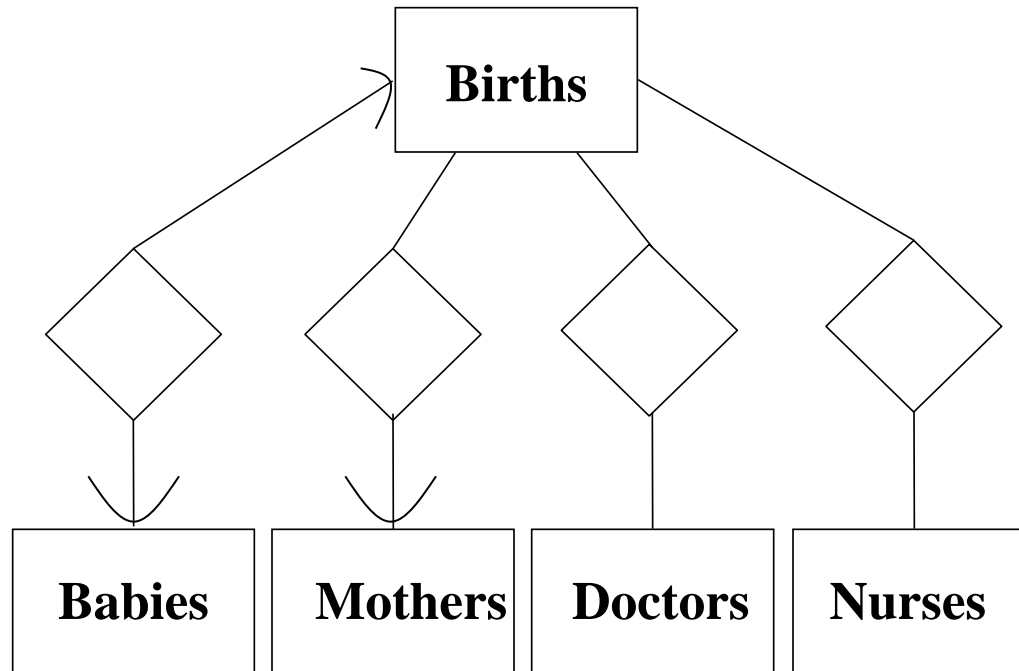


# Exercise #11

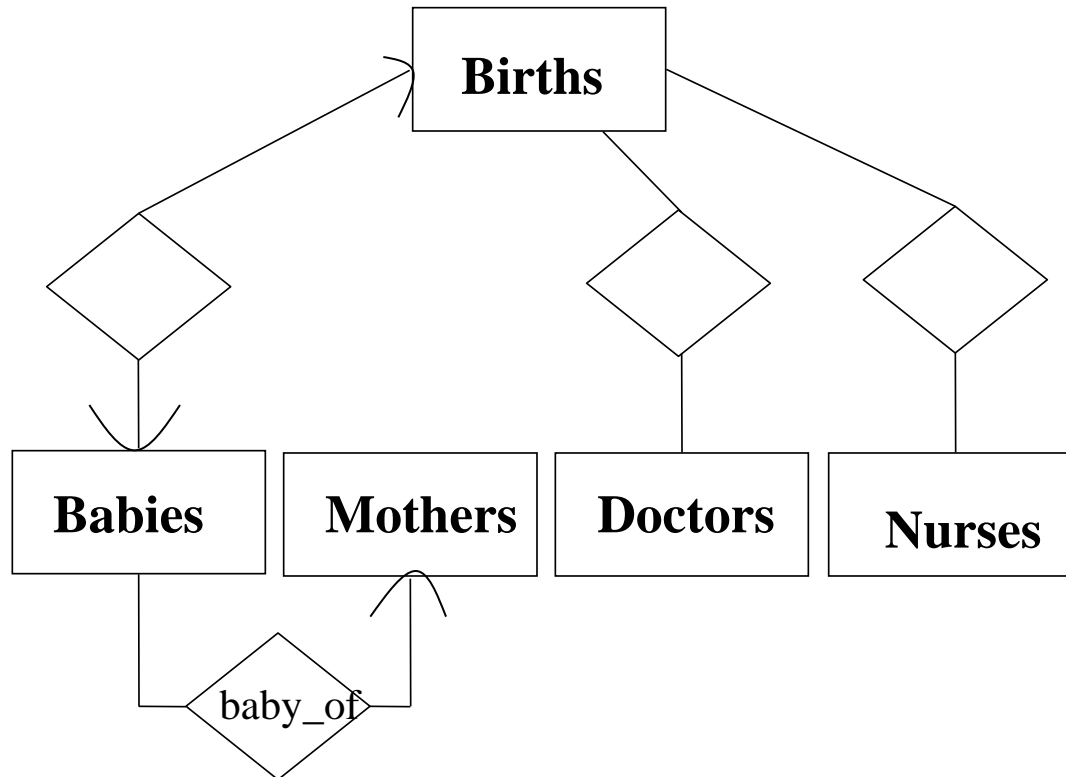
Further change this E/R diagram so that every baby has a unique mother.



# Solution #11-1

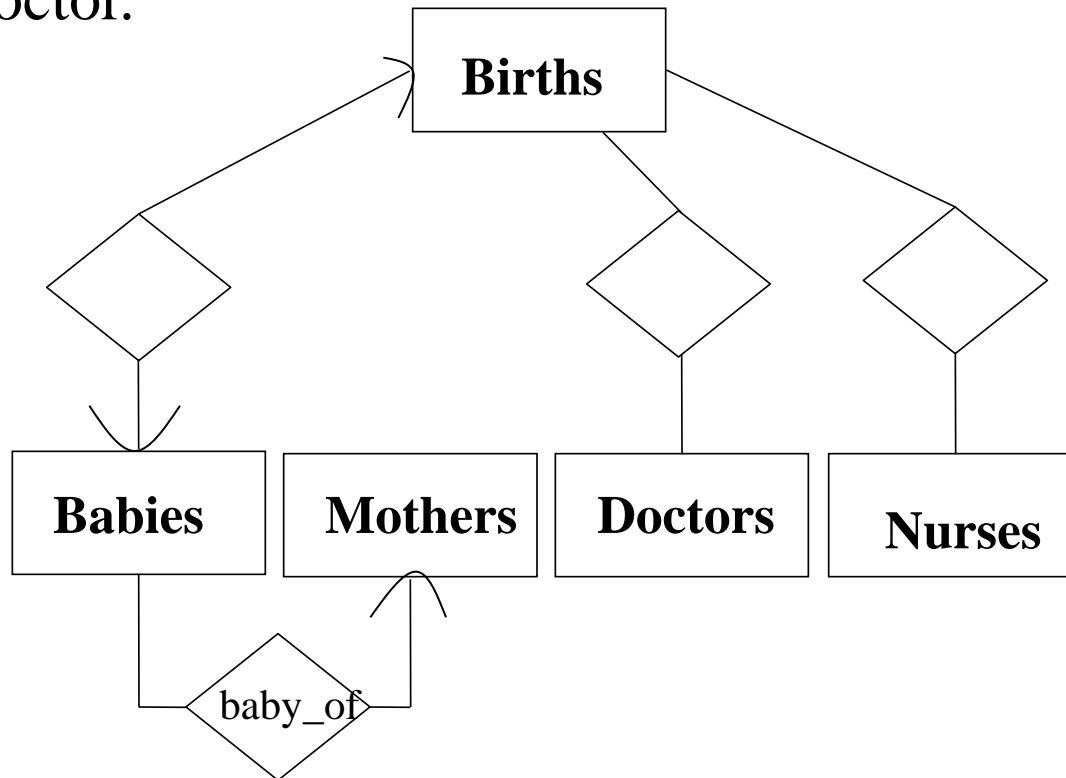


# Solution #11-2

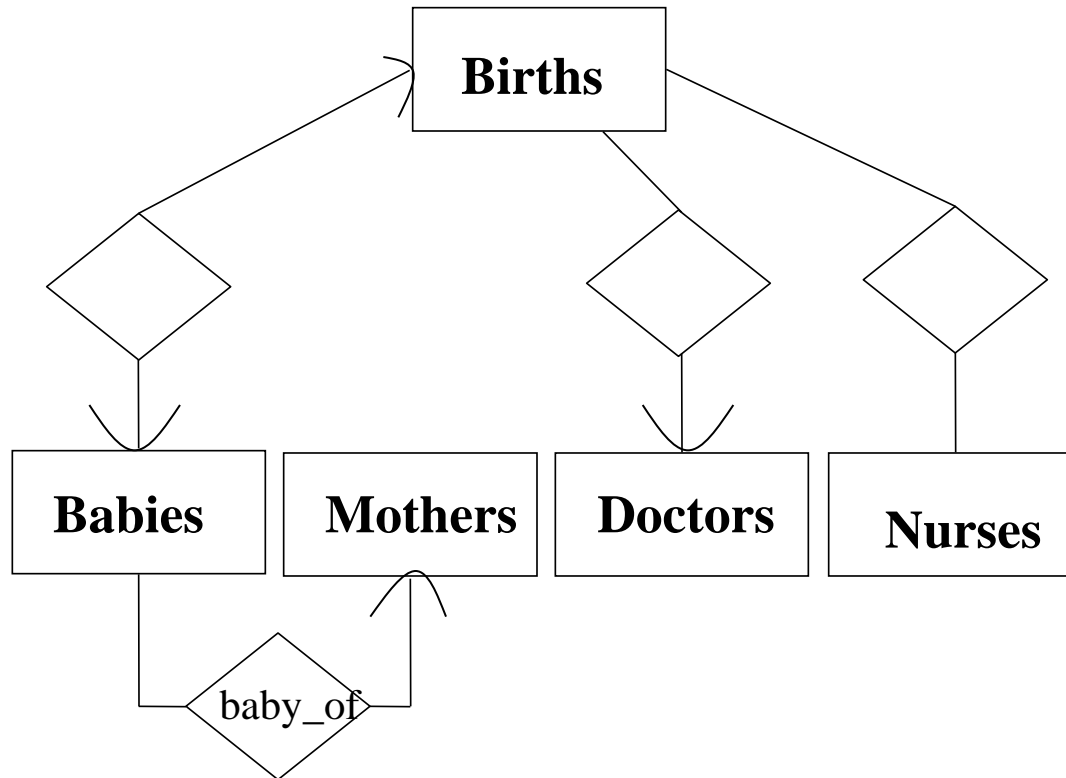


# Exercise #12

Further change this E/R diagram so that for every birth there is a unique doctor.

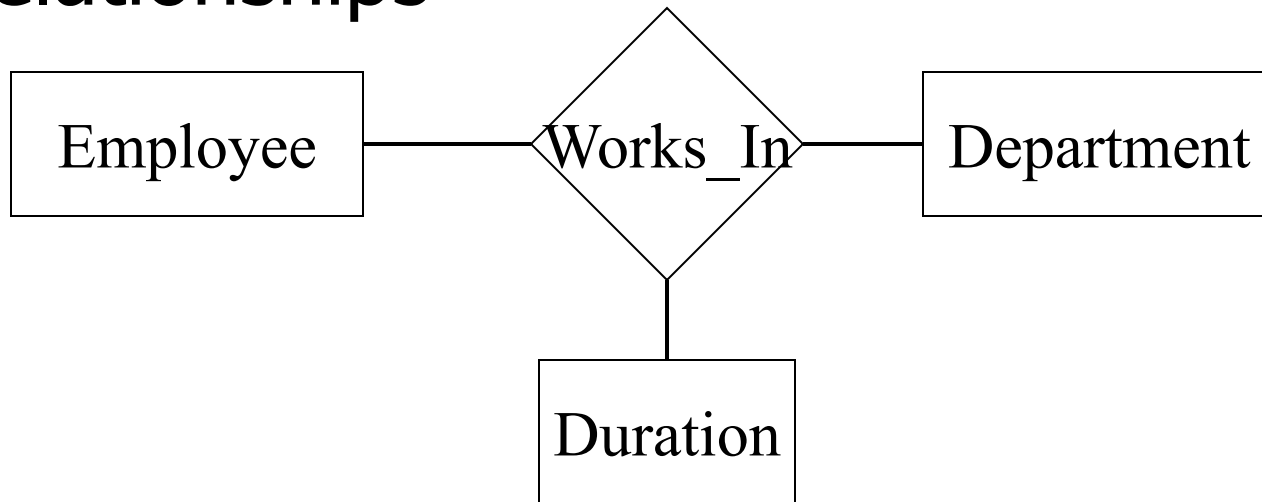


# Solution #12



# Exercise #13

- Convert the ternary relationship in the following E/R diagram into binary relationships



# Solution #13

- Create a new connecting weak entity set to represent rows of a relationship set.
- Many-one relationships from the connecting weak entity set to the others.

