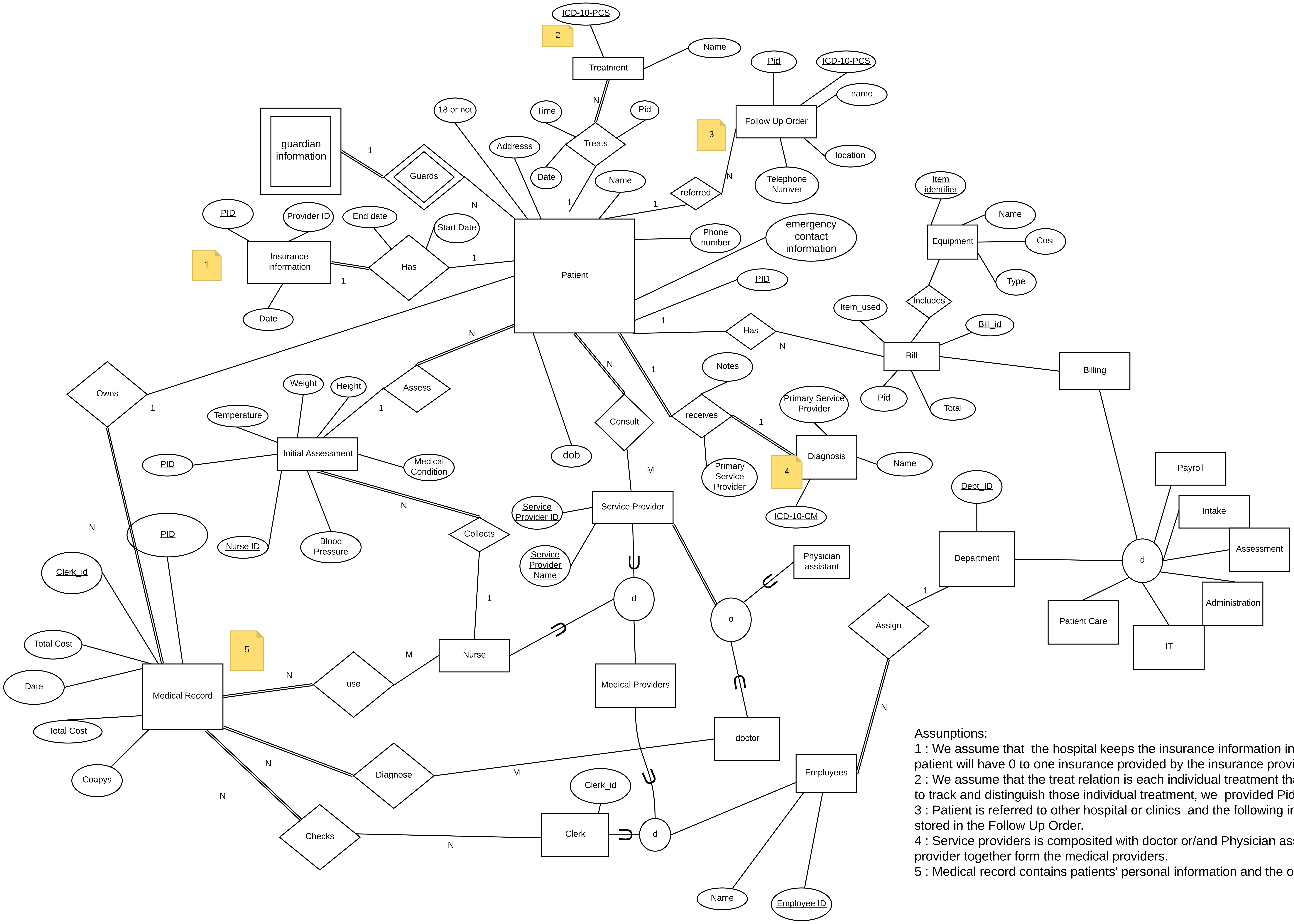

Assumptions:
1 : We assume that the hospital keeps the insurance information in a insurance information entity. Each patient will have 0 to one insurance provided by the insurance provider.
2 : We assume that the treat relation is each individual treatment that is provided to the patient. Therefore, to track and distinguish those individual treatment, we provided Pid, date and time.
3 : Patient is referred to other hospital or clinics and the following information after the referrel will be stored in the Follow Up Order.
4 : Service providers is composited with doctor or/and Physician assistent. Then both nurse and Service provider together form the medical providers.
5 : Medical record contains patients' personal information and the onlie form generated by intake clerk .

CSci 4707 Project
Mapping for ER-diagram

Team 18:

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Step 1: Mapping of regular entities -- Combined with Step 8: Mapping of specialization and generalization

Assumptions:

1. As the specialization of Employee and Service Provider are not complete, and they are disjoint, we include the primary key of superclass (Employee and Medical_Provider) in relations of subclasses, as the primary keys. And mark them as foreign keys referencing superclasses. Being disjoint means an employee can only be a clerk or a medical provider, and a medical provider can only be a nurse or a service provider.

In relation Clerk, as a foreign key, but also as a primary key, Employee_ID cannot be NULL, but only be any value of Employe_ID in Employee.

In relation Medical Provider, as a foreign key, but also as a primary key, Employee_ID cannot be NULL, but only be any value of Employe_ID in Employee.

In relation Nurse, as a foreign key, but also as a primary key, Employee_ID cannot be NULL, but only be any value of Employe_ID in Medical_Provider.

In relation Service Provider, as a foreign key, but also as a primary key, Employee_ID cannot be NULL, but only be any value of Employe_ID in Medical_Provider.

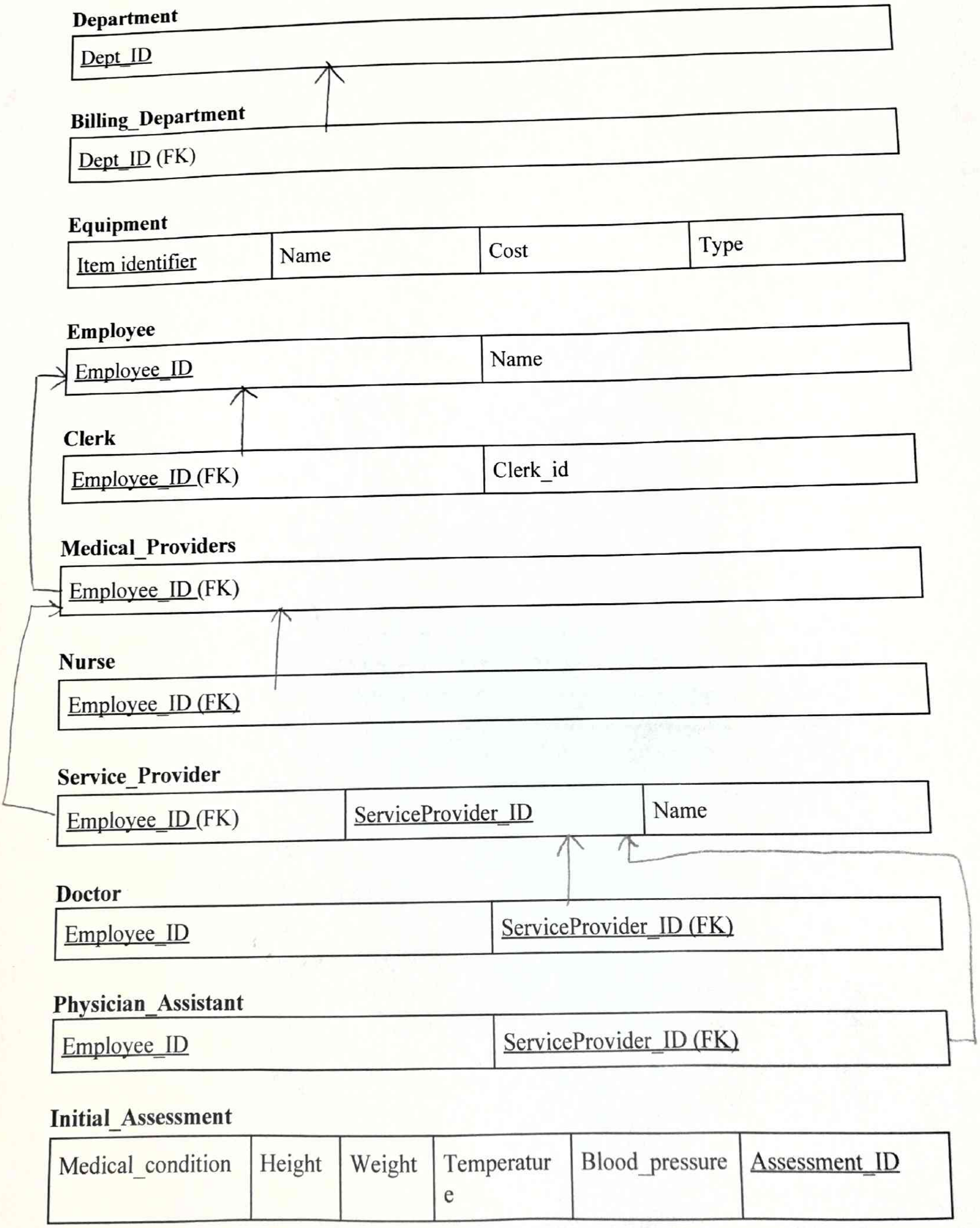
2. As the specialization of Service Provider is complete, and it is overlapping, we include the primary key of superclass (Service_Provider) in relations of subclass, as the primary key. And mark it as foreign keys referencing the superclass. Being overlapping means an employee can be a doctor and a Physical_Assistant at the same time.

In relation Doctor, as a foreign key, but also as a primary key, ServiceProvider_ID cannot be NULL, but only be any value of ServiceProvider_ID in Service_Provider. Employee_ID is also a primary key in Doctor.

In relation Physical_Assistant, as a foreign key, but also as a primary key, ServiceProvider_ID cannot be NULL, but only be any value of ServiceProvider_ID in Service_Provider. Employee_ID is also a primary key in Physical_Assistant.

Patient

Date_of_birth	PID	Emergence_contact_info	Phone_number	18_or_not	Address	Name	Guardian_ID



Department

Dept_ID

Billing_Department

Dept_ID (FK)

Equipment

Item identifier	Name	Cost	Type

Employee

Employee_ID	Name

Clerk

Employee_ID (FK)	Clerk_id

Medical_Providers

Employee_ID (FK)

Nurse

Employee_ID (FK)

Service_Provider

Employee_ID (FK)	ServiceProvider_ID	Name

Doctor

Employee_ID	ServiceProvider_ID (FK)

Physician_Assistant

Employee_ID	ServiceProvider_ID (FK)

Initial_Assessment

Medical_condition	Height	Weight	Temperatur e	Blood_pressure	Assessment_ID

Bill

Bill_id

Insurance_Information

Insurance_order_ID	Date

Treatment

ICD-10-PCS	Name

Medical_Record

Clerk_id	Date	Total_cost	Coapys	Record_ID

Follow_up_Order

PID	ICD-10-PCS	name	location	Telephone_numbenr

Diagnosis

ICD-10-CM	Primary_servers_provider	Name

Step 2: Mapping of weak entities

There is one one weak entity in our diagram:

1. Patient might have a guardian information as a weak entity of it.

Patient

Date_of_birth	PID	Emergence_contact_info	Phone_number	18_or_not	Address	Name	Guardian_ID

Guardian_infomation

Guardian_id	PID (FK)	Name	Address	Relation_with_patient	Contact_info

Guardian_information is a weak entity derived from patient. Each patient will have one guardian that will be contacted when they got into hospital if they are not adults. Or no guardian will be listed if they are adult. Also, each patient with guardian will only have one guardian and each guardian can be guardian of 0 or multiple children.

The primary key of Patient is included as a foreign key and primary key of the weak entity Guardian_information, which is PID, and it cannot be NULL.

Step 3: Mapping of binary 1:1 relationships types

1. RECEIVES relationship:

   We use cross-reference method. We create a new relation R choose RECEIVES as S and PATIENT as T. Include the primary key(PID, ICD-10-CM) of T and S. We choose one of them (PID) as a primary key of R, the other(ICD-10-CM) as a foreign key of R. ICD-10-CM can be NULL in as it is only a foreign key in Receives.

Receives

PID	ICD-10-CM (FK)	Notes	Primary_Service_Provider

Patient

Date_of_birth	PID	Emergence_contact_info	Phone_number	18_or_not	Address	Name	Guardian_ID

Diagnosis

ICD-10-CM	Primary_servers_provider	Name

2. HAS relationship (Patient HAS Insurance information):

   We chose the foreign key approach. We chose Insurance information as S because it has total participation. We included the primary key (PID) of Patient as foreign key. We also included the relationship attributes of HAS as attributes. PID can be NULL in Insurance_information as it is only a foreign key.

Patient

Date_of_birth	PID	Emergence_contact_info	Phone_number	18_or_not	Address	Name	Guardian_ID

Insurance_Information

Insurance_order_ID	Date	Start_date	End_date	PID (FK)

Step 4: Mapping of binary 1:N relationships types

There are 9 instances of 1:N relationships:

1. Each patient being referred to N follow up order
2. Each patient being treated by N treatments
3. Each patient pays N bills
4. Each bill will include N equipment used

5. Billing department charges N bills
6. Employees being assigned to 1 department
7. Each nurses can collect N Initial Assessments
8. Each patient do 1 Initial Assessment
9. Each patient owns N medical record

1. Each patient being referred to N follow up order

Patient

Date_of_birth	PID	Emergence_contact_info	Phone_number	18_or_not	Address	Name	Guardian_ID

Follow_up_order

PID (FK)	ICD-10-PCS	name	location	Telephone_numbenr

We choose Follow_up_order to be S for total participation and Patient for T. In this relation, we add PID into Follow_up_order as a foreign key pointing to the Patient entity, and PID can be null in Treats, but will not actually be NULL.

2. Each patient being treated by N treatments

Patient

Date_of_birth	PID	Emergence_contact_info	Phone_number	18_or_not	Address	Name	Guardian_ID

Treatment

ICD-10-PCS	Name

Treats

ICD-10-PCS (FK)	PID (FK)	Time	Date

We use cross-reference method. We choose Treatment as S for total participation and Patients as T. For this relation, we create a new relation entity Treats. The primary key of this relation is the primary key of Treatment entity, which is ICD-10-PCS. So it can not be NULL. Then the foreign keys of this relation are the primary keys of Treatment and Patient, but both of them cannot be NULL. Some attributes Time and Date are also included in this relation.

3. Each patient pays N bills

Patient

Date_of_birth	PID	Emergence_contact_info	Phone_number	18_or_not	Address	Name	Guardian_ID

Bill

Bill_id	PID (FK)

We choose Bill to be S for total participation and Patient for T. In this relationship, we add PID into Bill as a foreign key pointing to the Patient entity, and it can be NULL, but it will not actually be NULL.

4. Each bill will include N equipment used

Bill

Bill_id	PID	Used_item_ID (FK)

Equipment

Item identifier	Name	Cost	Type

We choose Equipment to be S for total participation and Bill for T. In this relationship, we add Used_item_ID into Bill entity as a foreign key pointing to the Equipment entity, and it can be NULL.

5. Billing department charges N bills

Bill

Bill_id	PID	Used_item_ID	Dept_ID (FK)

Billing_Department

Dept_ID

We choose Bill to be S for total participation and Patient for T. In this relationship, we add Dept_ID into Bill entity as a foreign key pointing to the Billing_Department entity, and it can be NULL.

6. Employees being assigned to 1 department

Employee

Employee_ID	Name	Dept_ID (FK)

Department

Dept_ID

We choose Employee to be S for total participation and Department for T. In this relationship, we add Dept_ID into Employee entity as a foreign key pointing to the Department entity, and it can be NULL.

7. Each nurses can collect N Initial Assessments

Nurse

Employee_ID

Initial_Assessment

Medical_condition	Height	Weight	Temperature	Nurse_ID (FK)	Blood_pressure	Assessment_ID

We choose Initial_Assessment to be S for total participation and Nurse for T. In this relationship, we add Nurse_ID into Initial_Assessment entity as a foreign key pointing to the Nurse entity, and it can be NULL.

8. Each patient do 1 Initial Assessment

Initial_Assessment

Medical_condition	Height	Weight	Temperature	Nurse_ID	Blood_pressure	Assessment_ID

Patient

Date_of_birth	PID	Emergence_contact_info	Phone_number	18_or_not	Address	Name	Guardian_ID	Assessment_ID (FK)

We choose Patient to be S for total participation and Initial_Assessment for T. In this relationship, we add Assessment_ID into Patient entity as a foreign key pointing to the Initial_Assessment entity, and it can be NULL.

9. Each patient owns N medical record

Patient

Date_of_birth	PID	Emergence_contact_info	Phone_number	18_or_not	Address	Name	Guardian_ID	Assessment_ID

Medical_Record

Clerk_id	PID(FK)	Date	Total_cost	Coapys	Record_ID

We choose Medical record to be S for total participation and patient for T. In this relationship, we add PID into Medical_Record entity as a foreign key pointing to the Patient entity, and it can be NULL, but it cannot be NULL actually.

Step 5: Mapping of binary M:N relationships types

We have M:N relationships:

1. Diagnose (Doctor - Medical Record)
2. Checks (Clerk - Medical Record)
3. Use (Nurse - Medical Record)
4. Consult (Patient - Service Provider)

1. Diagnose

We created a new relation called Diagnose. Primary keys of Doctor and Medical_Record are included as foreign keys. The primary keys of Diagnose are the combination of the two primary keys. They cannot be NULL.

Doctor

Employee_ID	ServiceProvider_ID

Diagnose

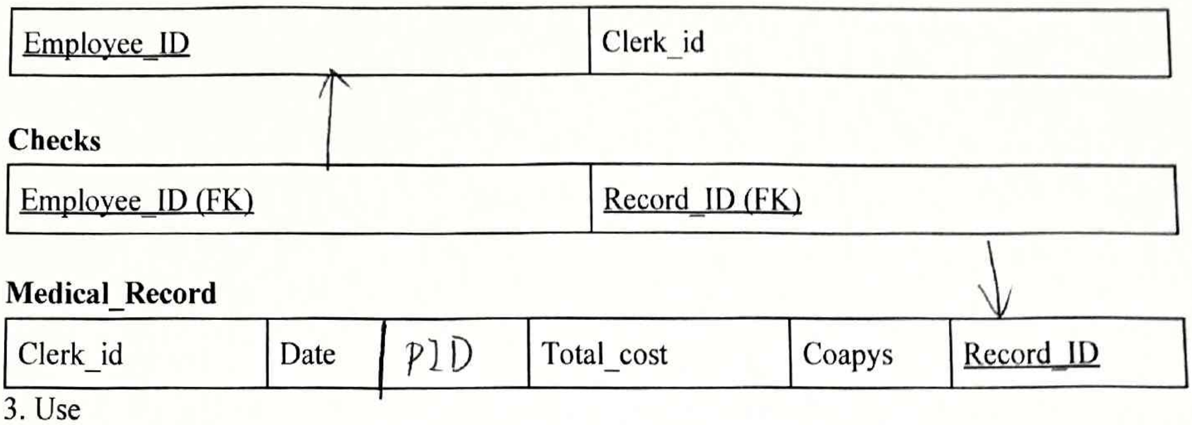
Record_ID (FK)	Employee_ID	ServiceProvider_ID (FK)

Medical_Record

Clerk_id	Date	PID	Total_cost	Coapys	Record_ID

2. Checks

We created a new relation called Checks. Primary keys of Clerk and Medical_Record are included as foreign keys. The primary key of Checks is the combination of the two primary keys. They cannot be NULL.



Clerk

Employee_ID	Clerk_id

Checks

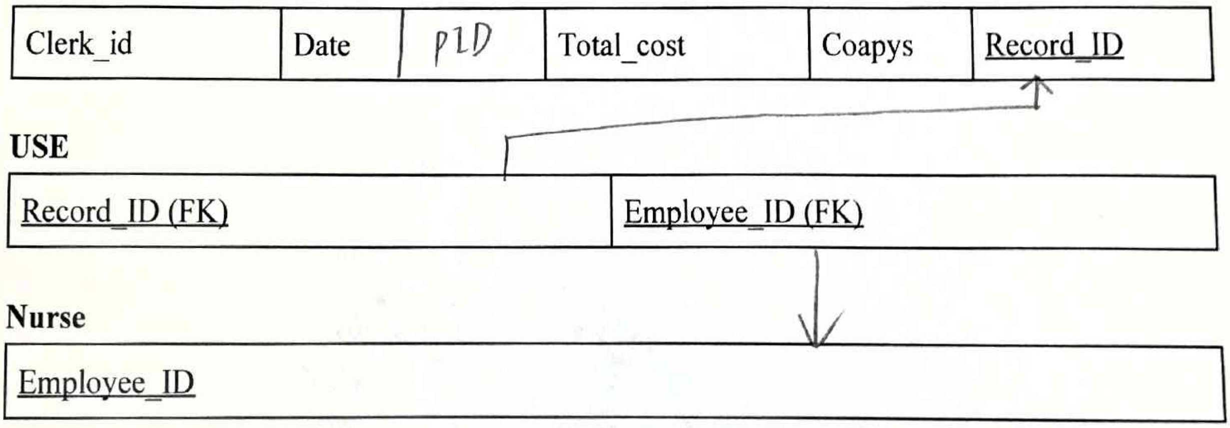
Employee_ID (FK)	Record_ID (FK)

Medical_Record

Clerk_id	Date	PID	Total_cost	Coapys	Record_ID

3. Use

We created a new relation called Use. Primary keys of Nurse and Medical_Record are included as foreign keys. The primary key of Use is the combination of the two primary keys. They cannot be NULL.



Medical_Record

Clerk_id	Date	PID	Total_cost	Coapys	Record_ID

USE

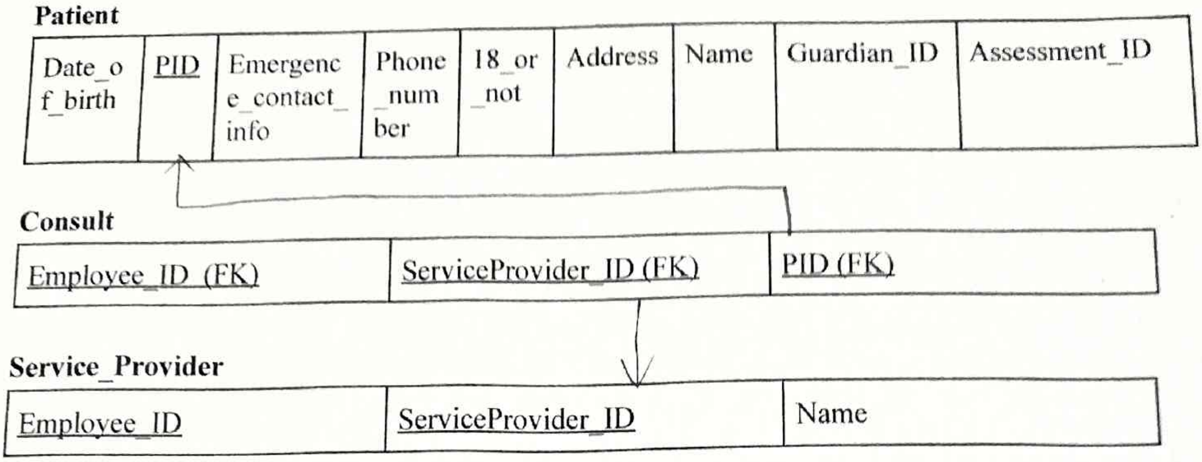
Record_ID (FK)	Employee_ID (FK)

Nurse

Employee_ID

4. CONSULT

We created a new relation called Consult. Primary keys of Patient and Service_Provider are included as foreign keys. The primary key of Consult is the combination of the two primary keys. They cannot be NULL.



Patient

Date_of_birth	PID	Emergence_contact_info	Phone_number	18_or_not	Address	Name	Guardian_ID	Assessment_ID

Consult

Employee_ID (FK)	ServiceProvider_ID (FK)	PID (FK)

Service_Provider

Employee_ID	ServiceProvider_ID	Name

Step 6: Mapping of multivalued attributes

There is no multivalued attribute in this database.

Step 7: Mapping of N-ary relationships types

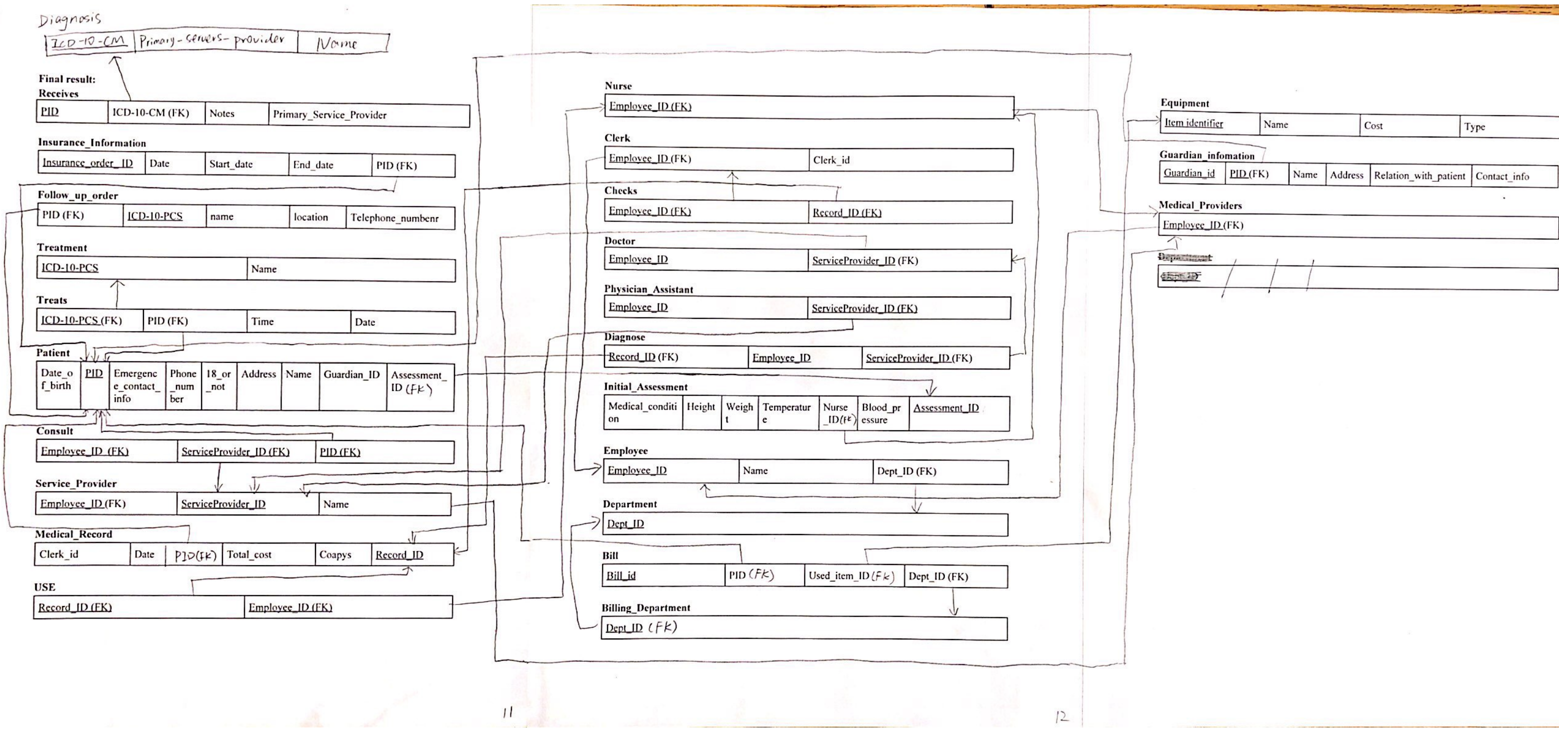
There is no N-ary relationships type in this database.

Step 8: Mapping of specialization and generalization

See step 1.

Step 9: Mapping of union types

There is no union type in this database.



Diagnosis

ICD-10-CM	Primary-servers-provider	Name

Final result:

Receives

PID	ICD-10-CM (FK)	Notes	Primary_Service_Provider

Insurance_Information

Insurance_order_ID	Date	Start_date	End_date	PID (FK)

Follow_up_order

PID (FK)	ICD-10-PCS	name	location	Telephone_numbenr

Treatment

ICD-10-PCS	Name

Treats

ICD-10-PCS (FK)	PID (FK)	Time	Date

Patient

Date_of_birth	PID	Emergence_contact_info	Phone_number	18_or_not	Address	Name	Guardian_ID	Assessment_ID (FK)

Consult

Employee_ID (FK)	ServiceProvider_ID (FK)	PID (FK)

Service_Provider

Employee_ID (FK)	ServiceProvider_ID	Name

Medical_Record

Clerk_id	Date	PID(FK)	Total_cost	Coapys	Record_ID

USE

Record_ID (FK)	Employee_ID (FK)

Nurse

Employee_ID (FK)

Clerk

Employee_ID (FK)	Clerk_id

Checks

Employee_ID (FK)	Record_ID (FK)

Doctor

Employee_ID	ServiceProvider_ID (FK)

Physician_Assistant

Employee_ID	ServiceProvider_ID (FK)

Diagnose

Record_ID (FK)	Employee_ID	ServiceProvider_ID (FK)

Initial_Assessment

Medical_condition	Height	Weight	Temperature	Nurse_ID(FK)	Blood_pressure	Assessment_ID

Employee

Employee_ID	Name	Dept_ID (FK)

Department

Dept_ID

Bill

Bill_id	PID (FK)	Used_item_ID (Fk)	Dept_ID (FK)

Billing_Department

Dept_ID (FK)

Equipment

Item identifier	Name	Cost	Type

Guardian_infomation

Guardian_id	PID (FK)	Name	Address	Relation_with_patient	Contact_info

Medical_Providers

Employee_ID (FK)

~~**Department**~~

~~Dept_ID~~