



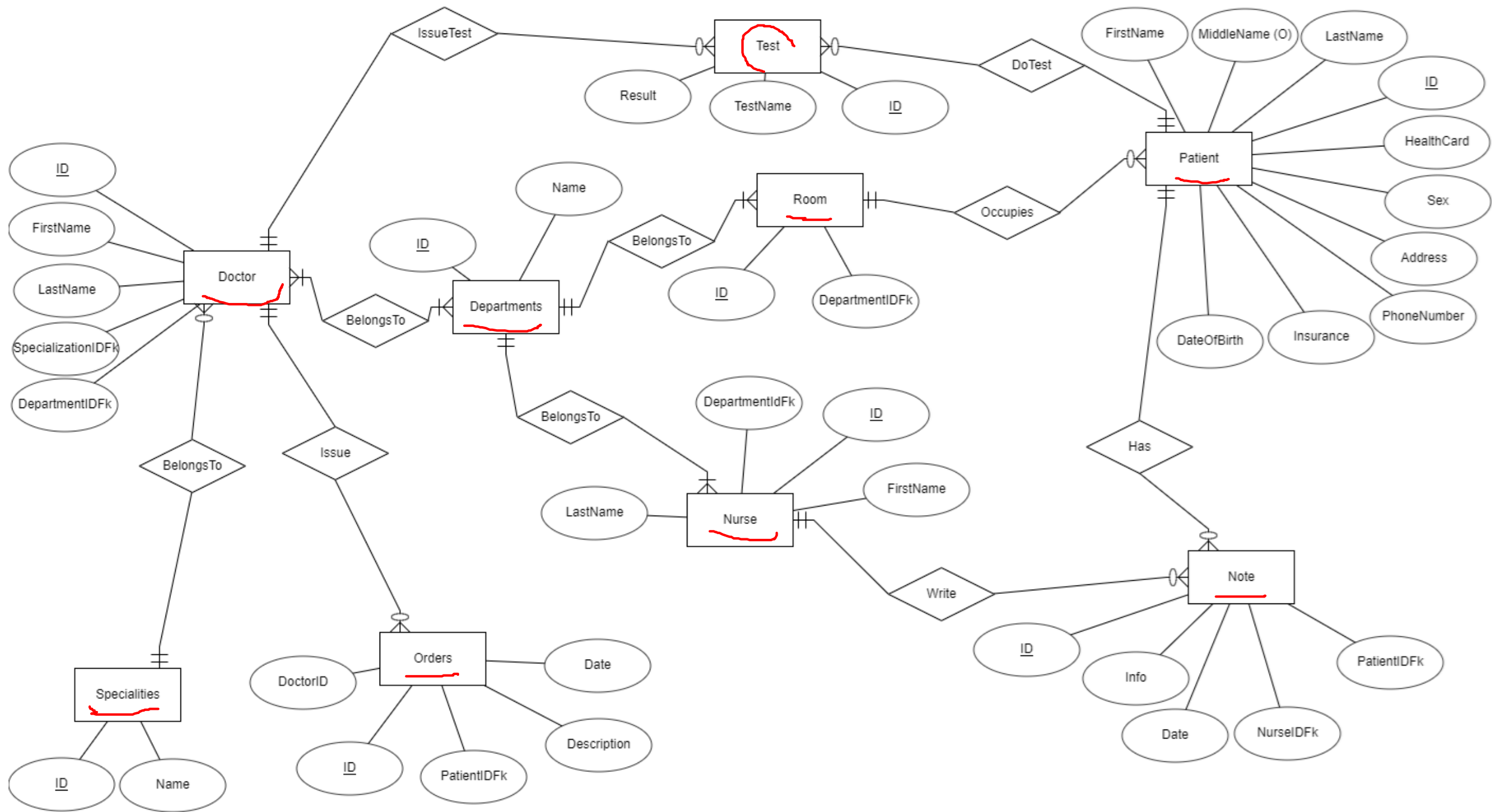
by Andreas Gursky, \$4.3 million, 2nd Most Expensive Photo
https://en.wikipedia.org/wiki/Rhein_II

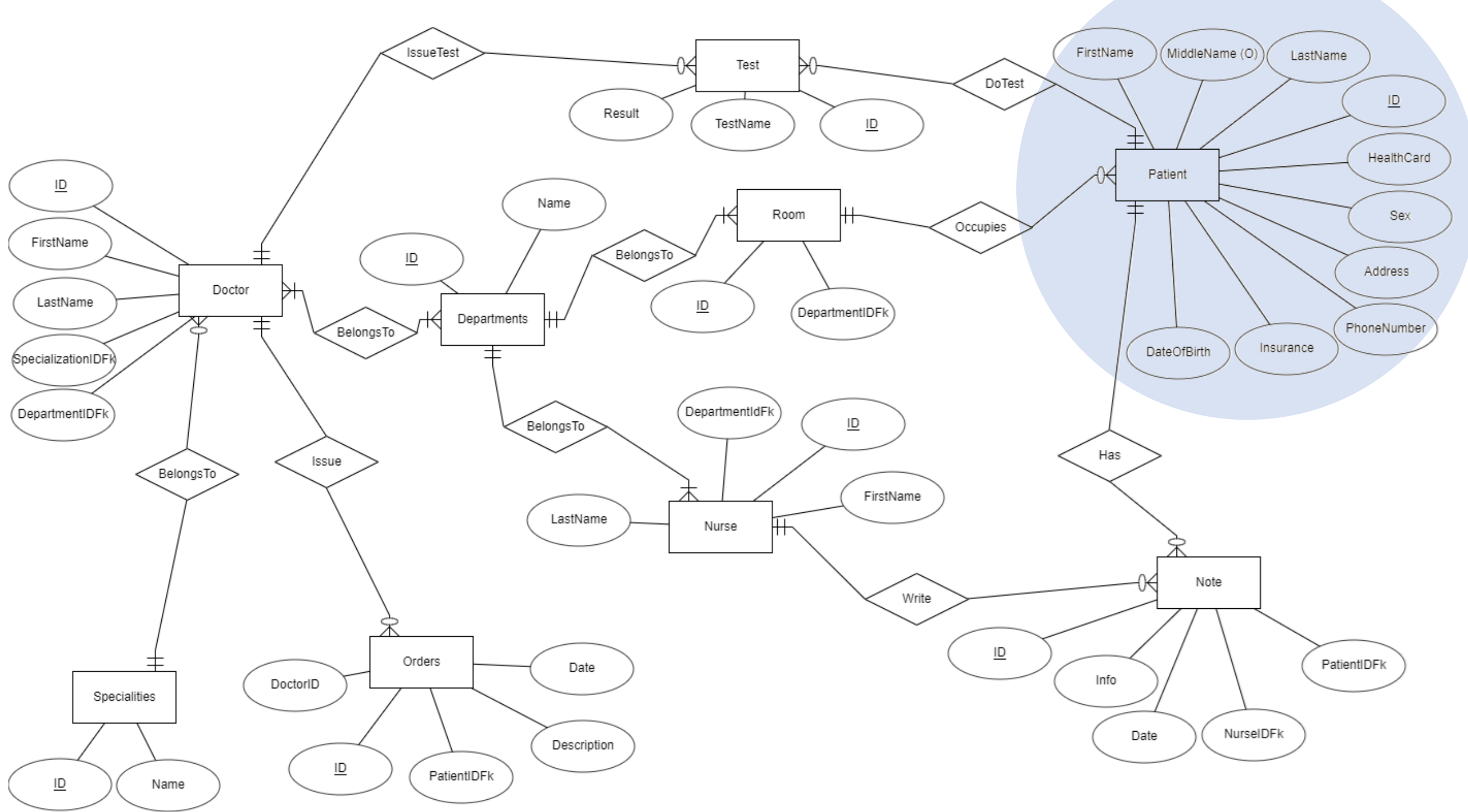


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by Andreas Gursky
https://en.wikipedia.org/wiki/Rhein_II



E/R 2 Relational × Workshop × Hospital 1

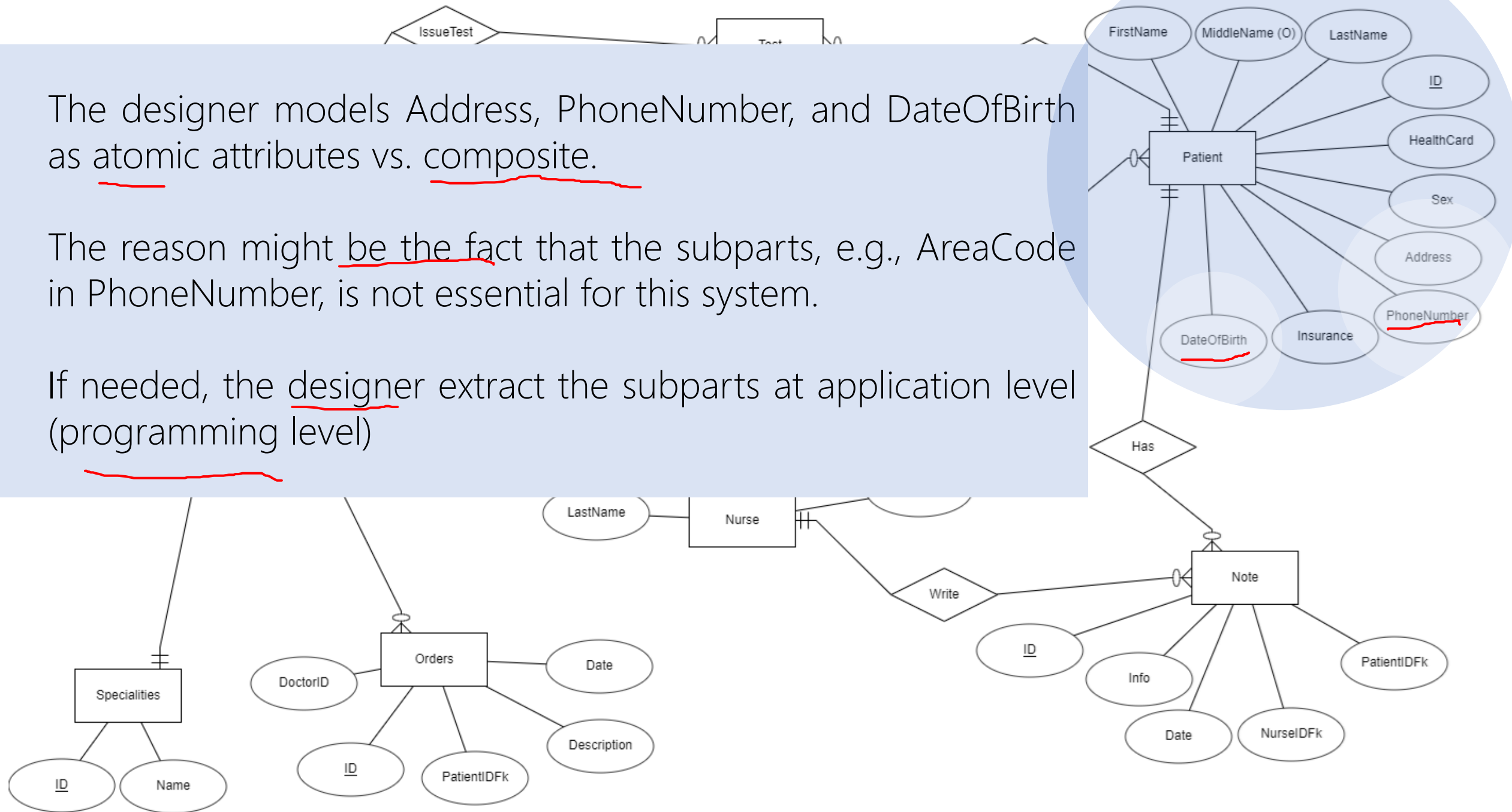




The designer models Address, PhoneNumber, and DateOfBirth as atomic attributes vs. composite.

The reason might be the fact that the subparts, e.g., AreaCode in PhoneNumber, is not essential for this system.

If needed, the designer extract the subparts at application level (programming level)



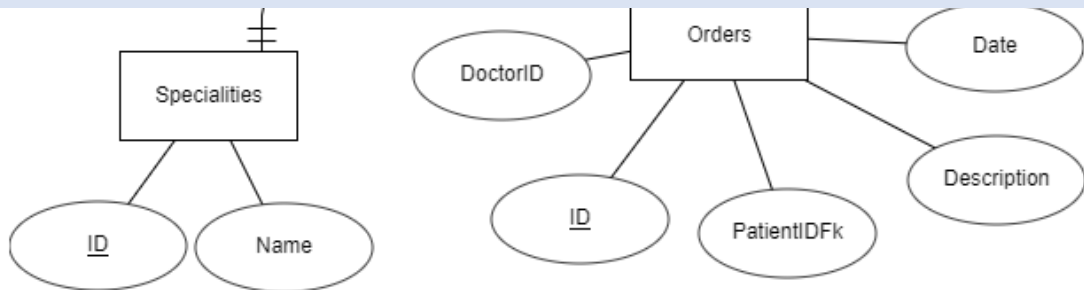
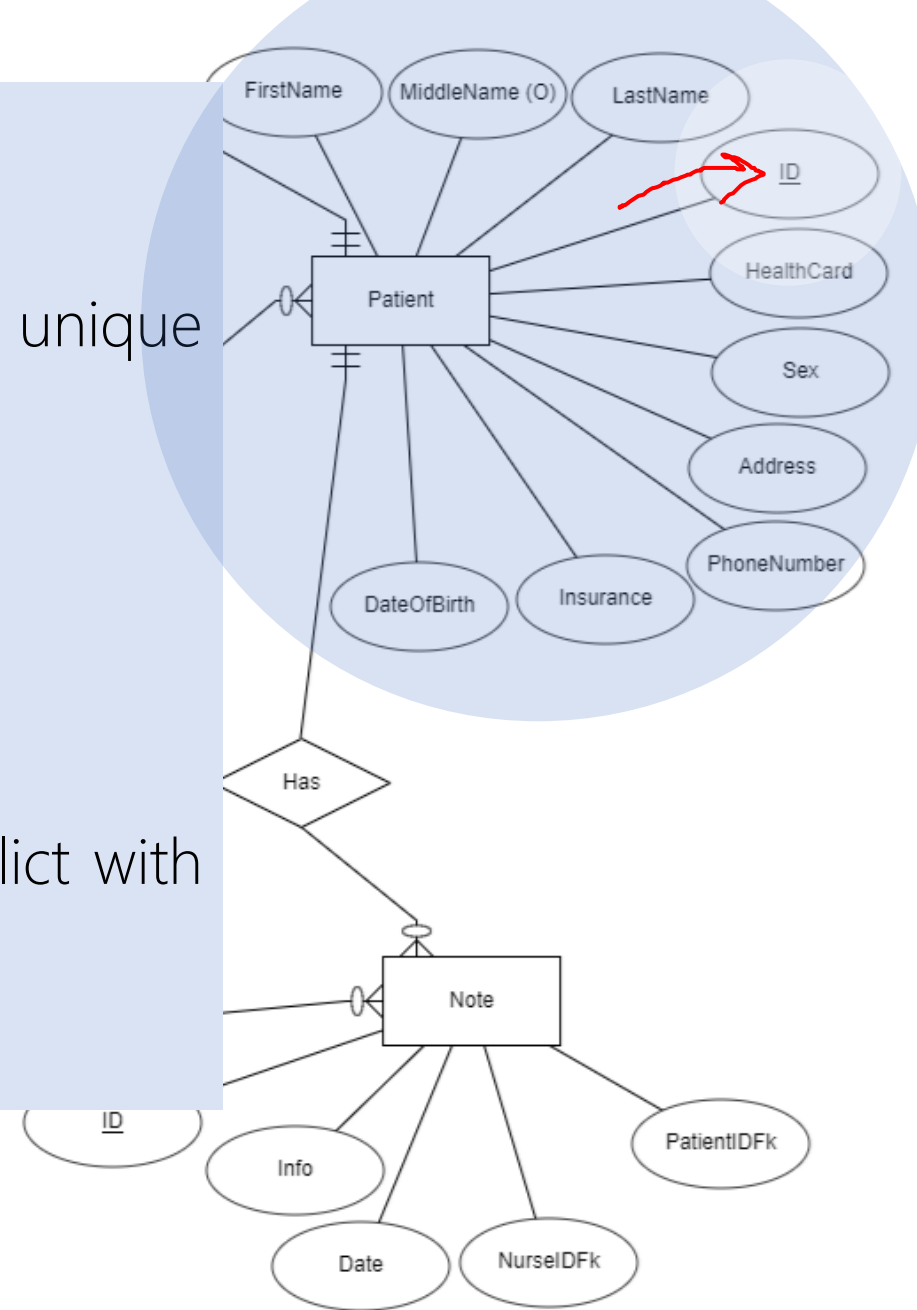
This is NOT a surrogate key.

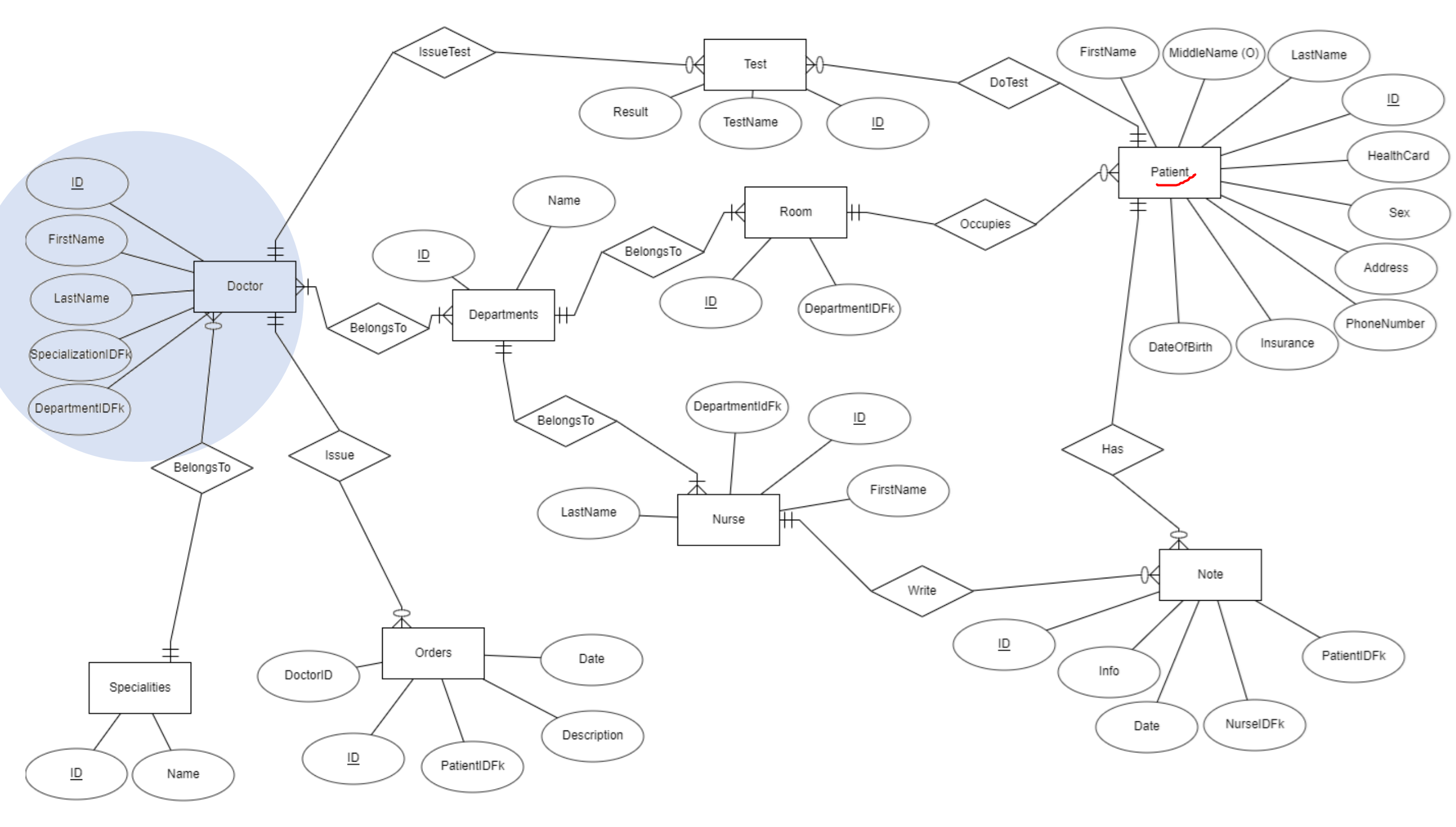
In real world, i.e., in a hospital, a patient is identified by a unique number.

Our system does not generate it!

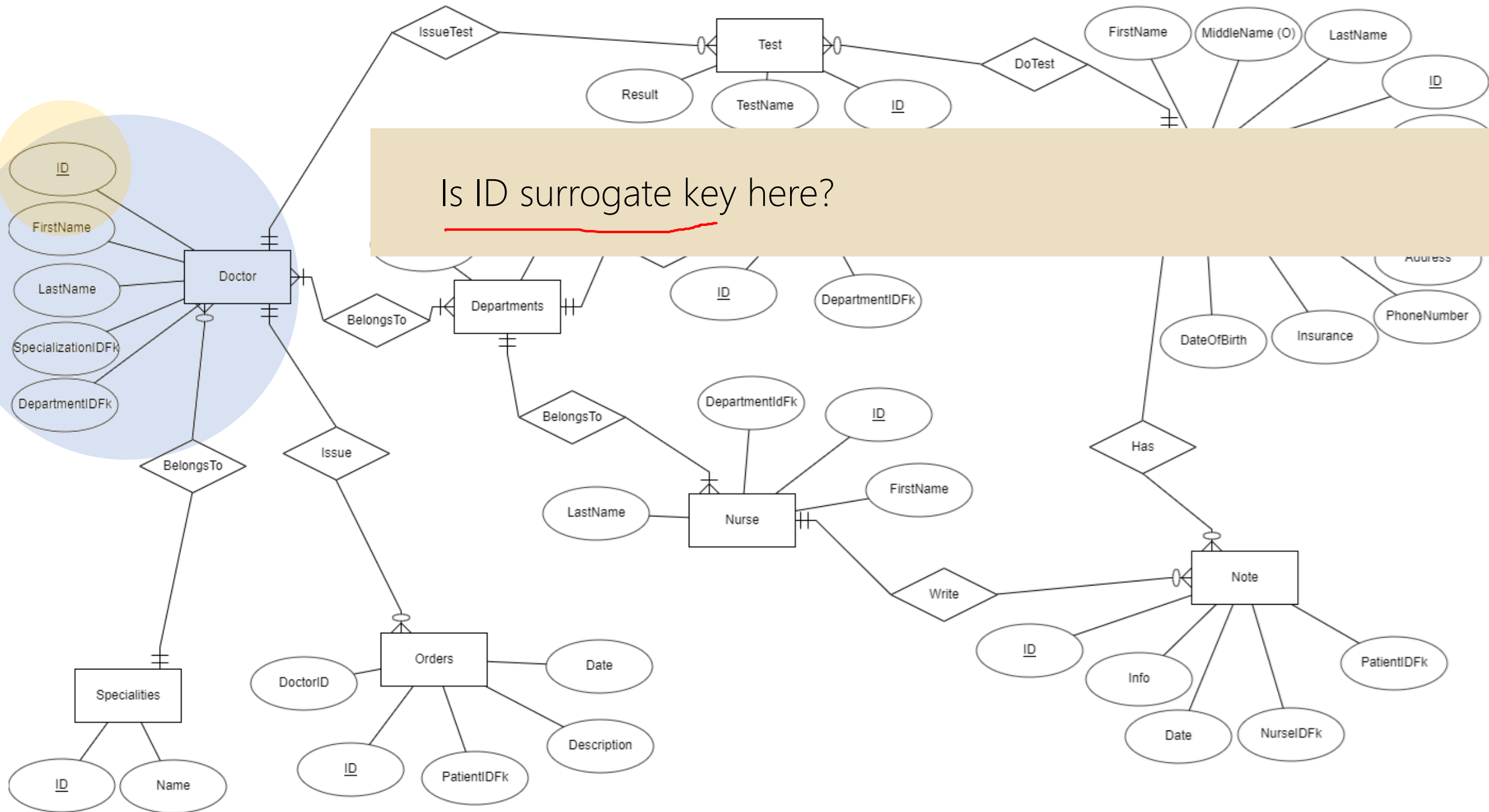
It is already assigned to a patient in a hospital.

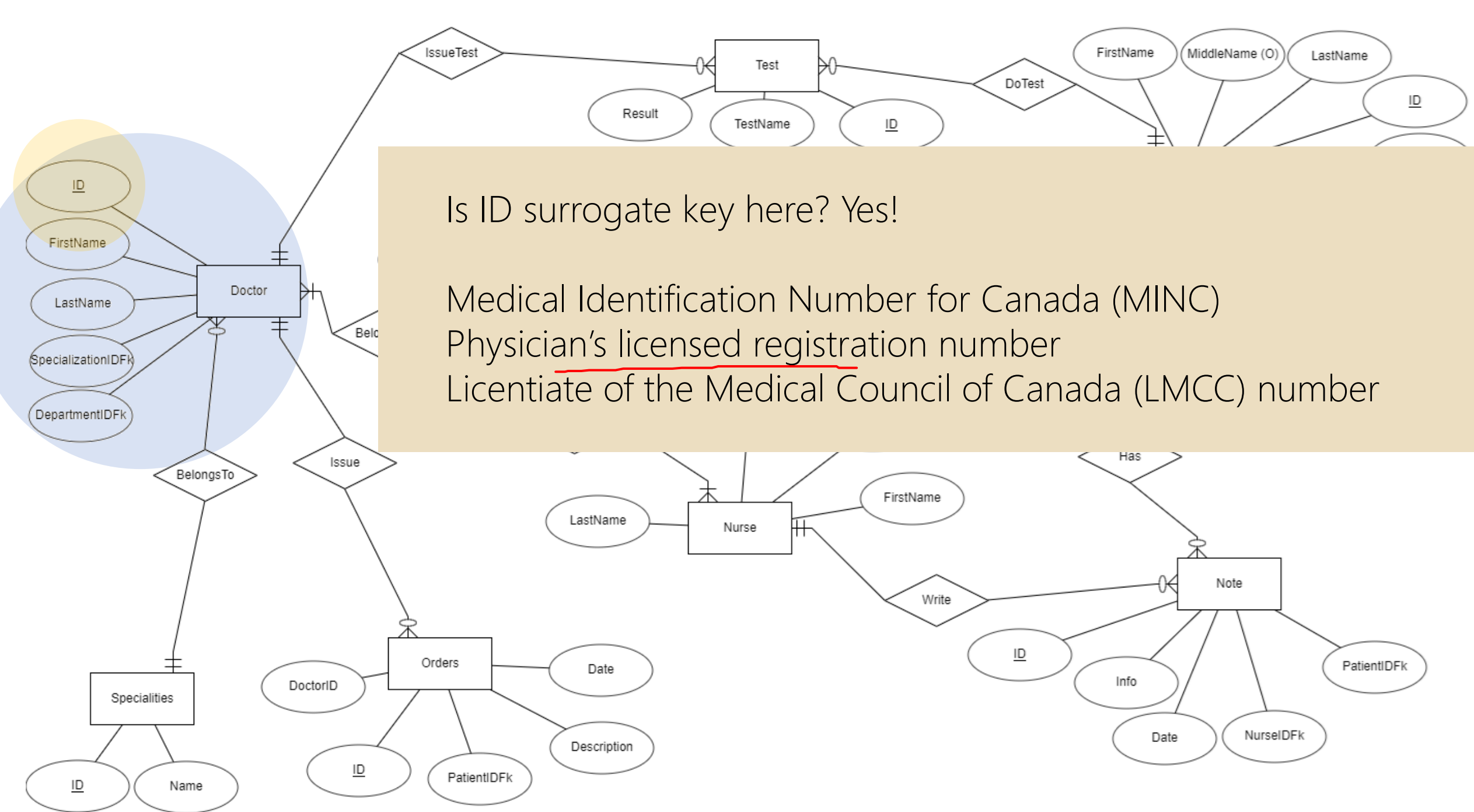
Let's rename it to Number in order to avoid name conflict with Id when creating surrogate key in our system.

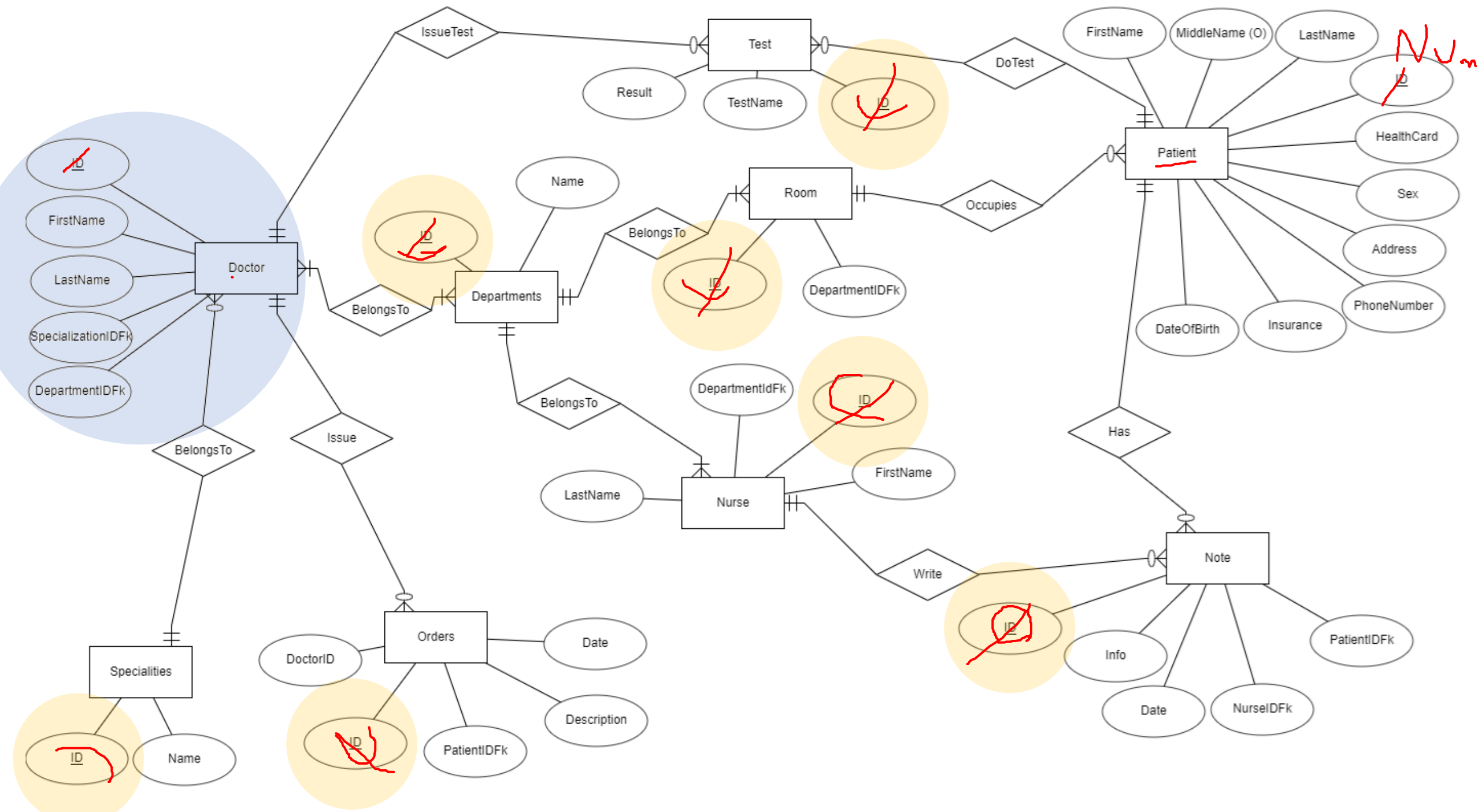


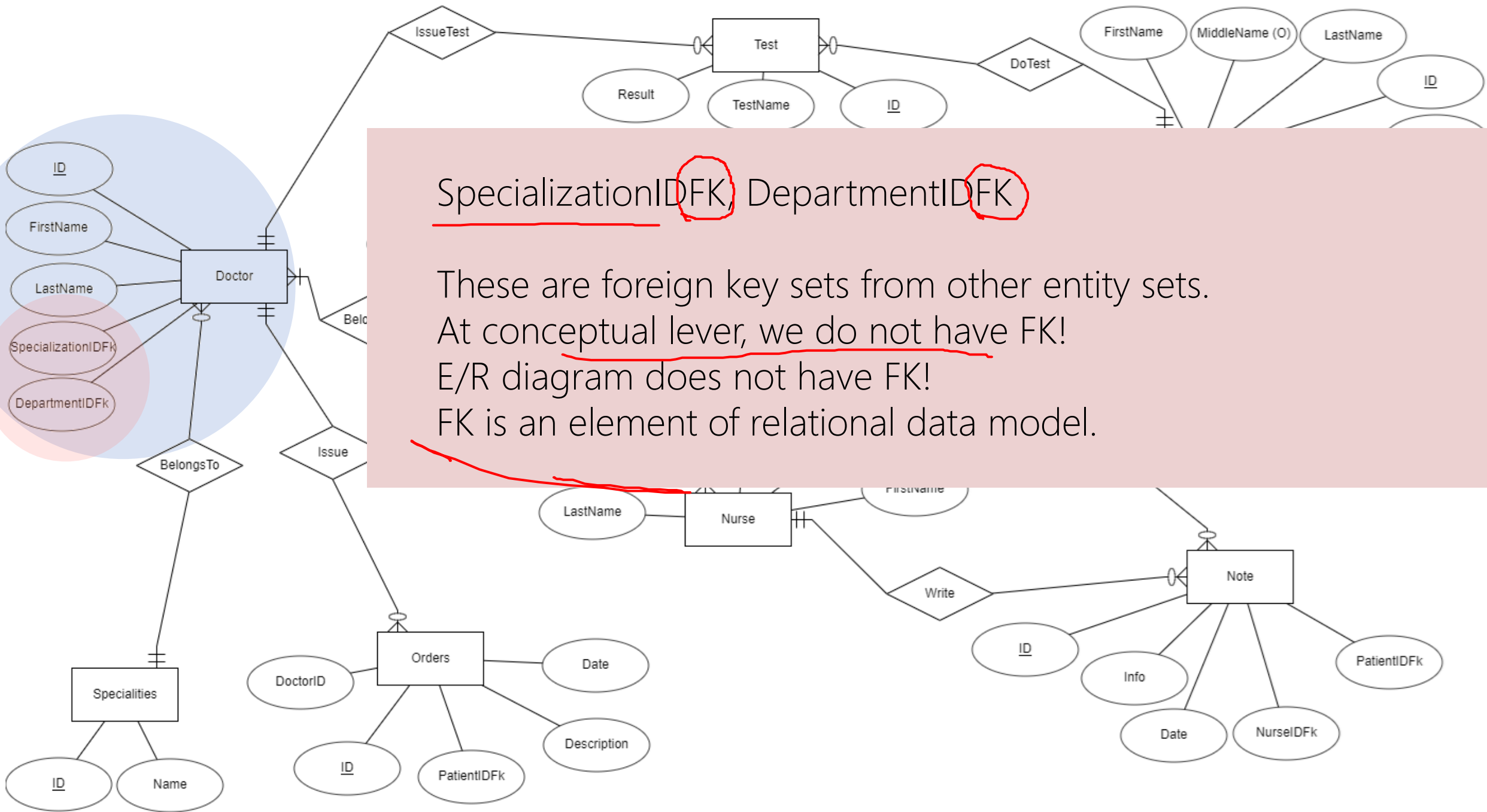


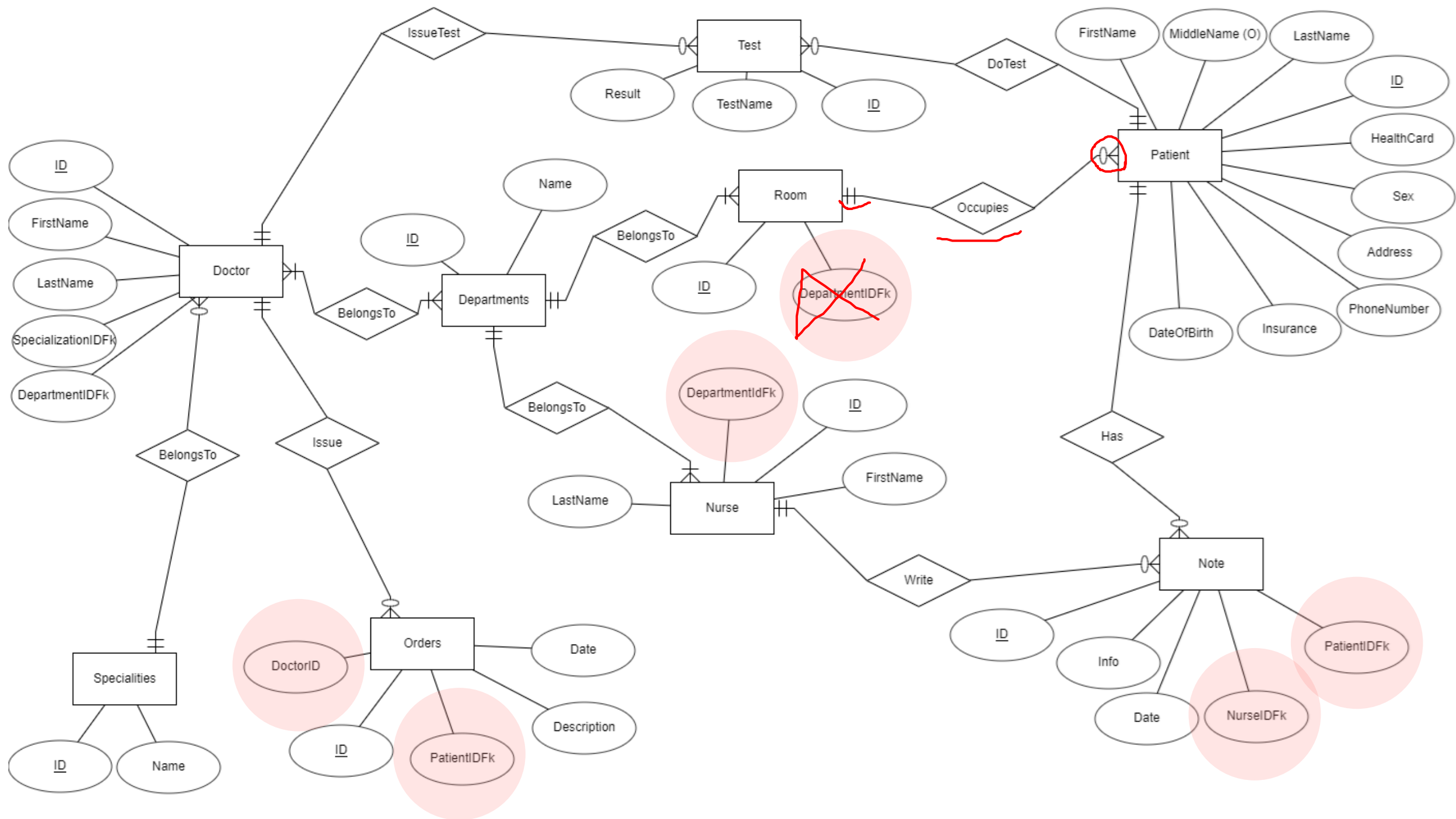
Is ID surrogate key here?

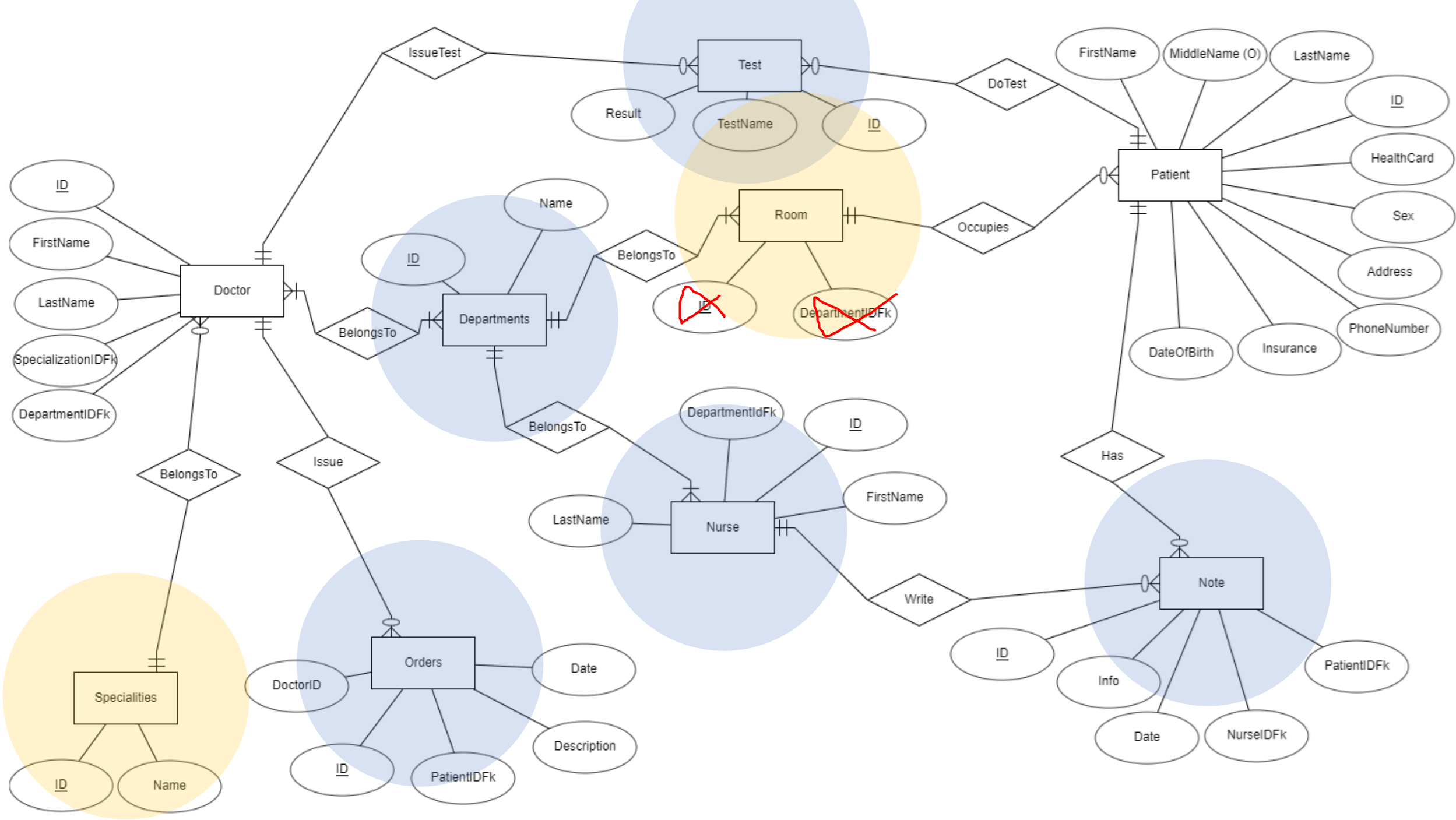


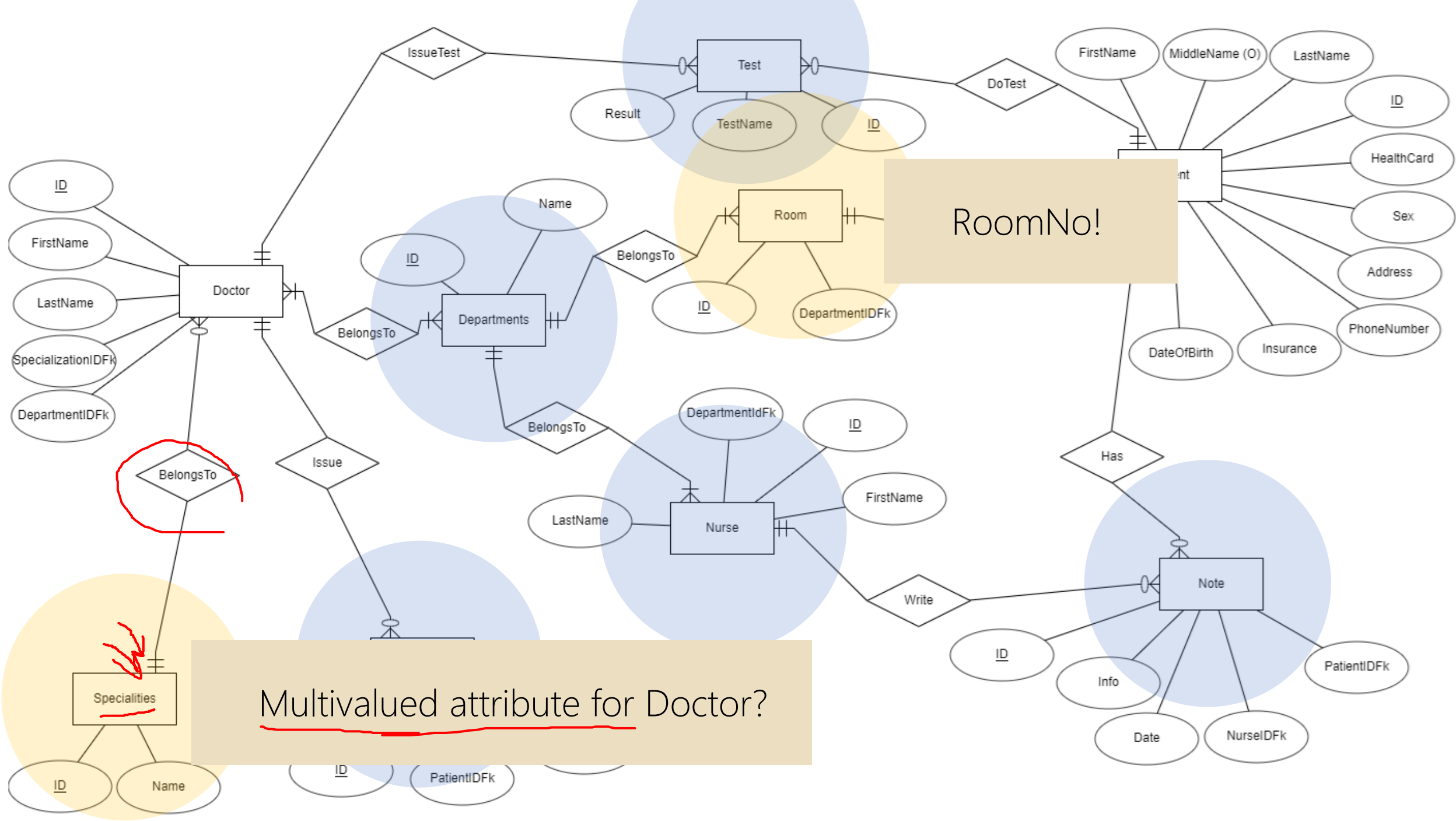


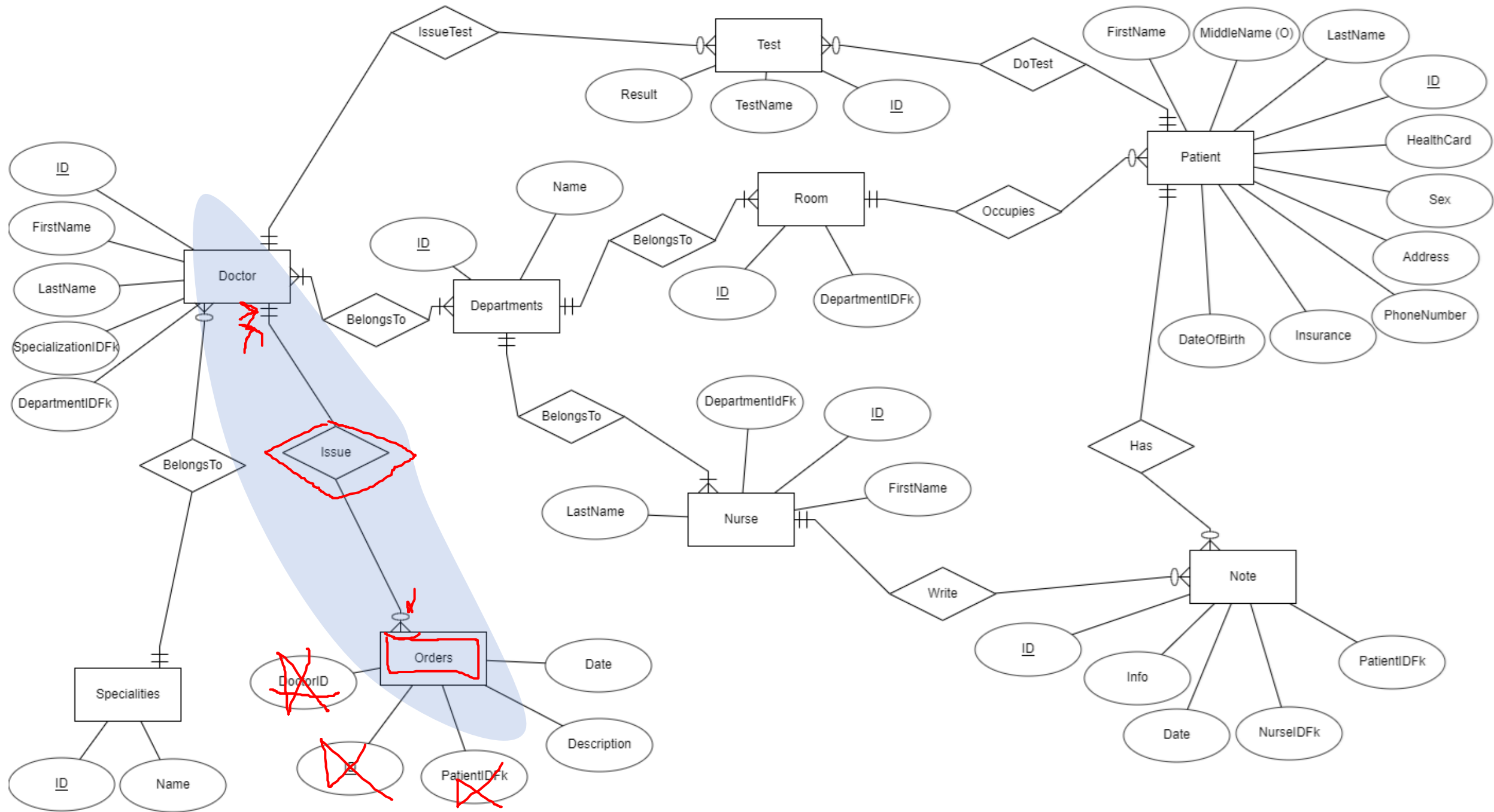


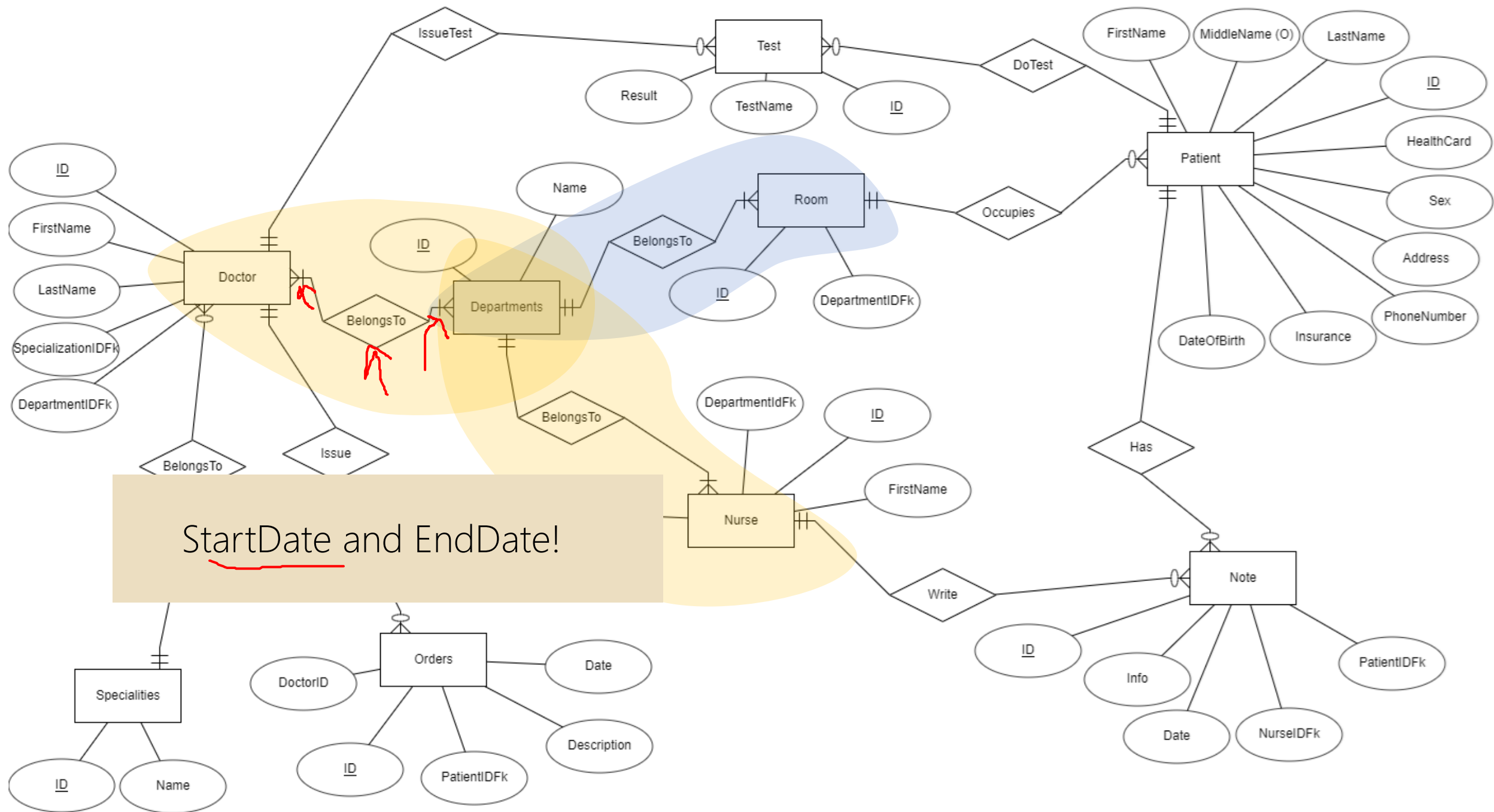






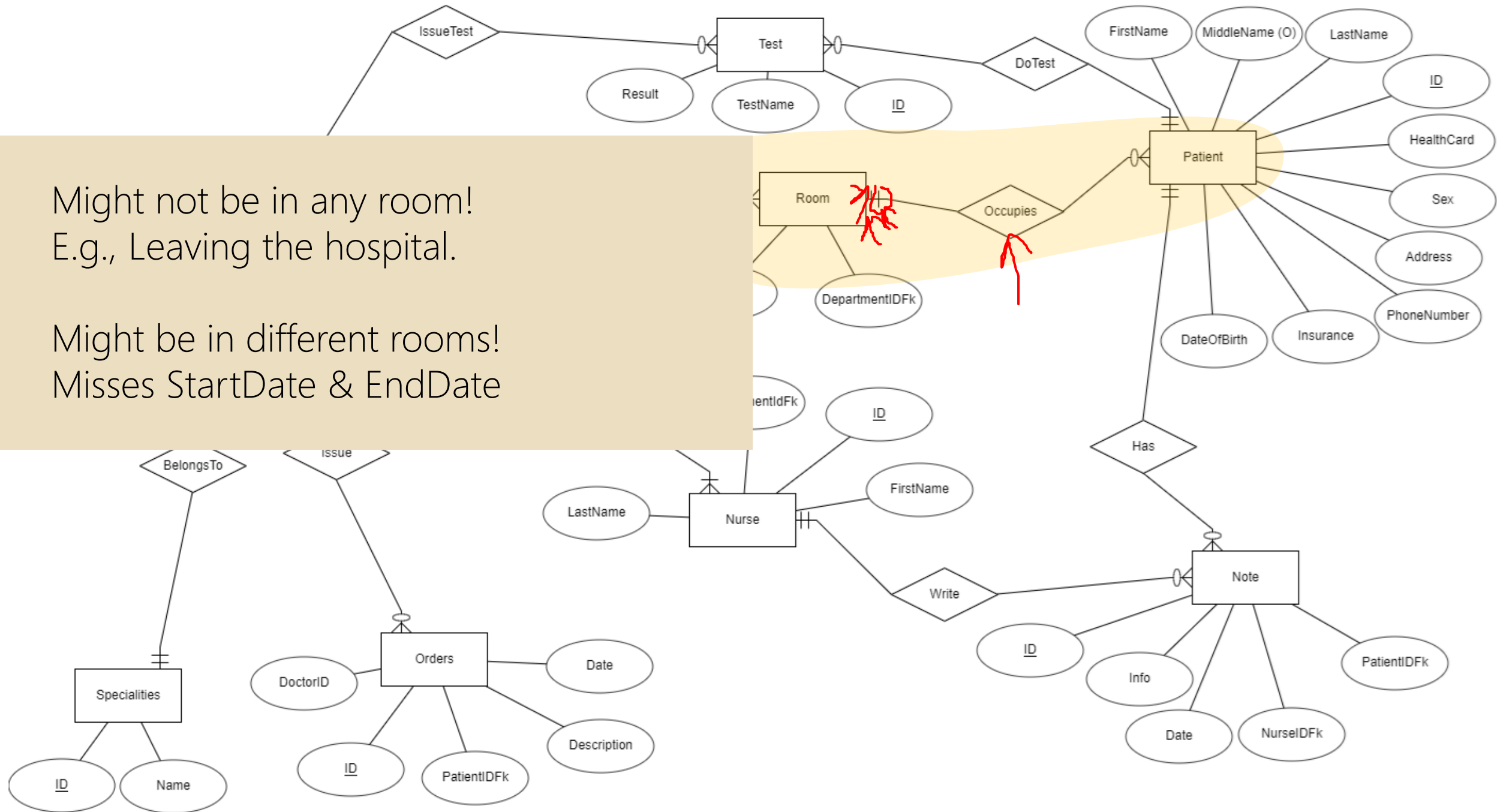


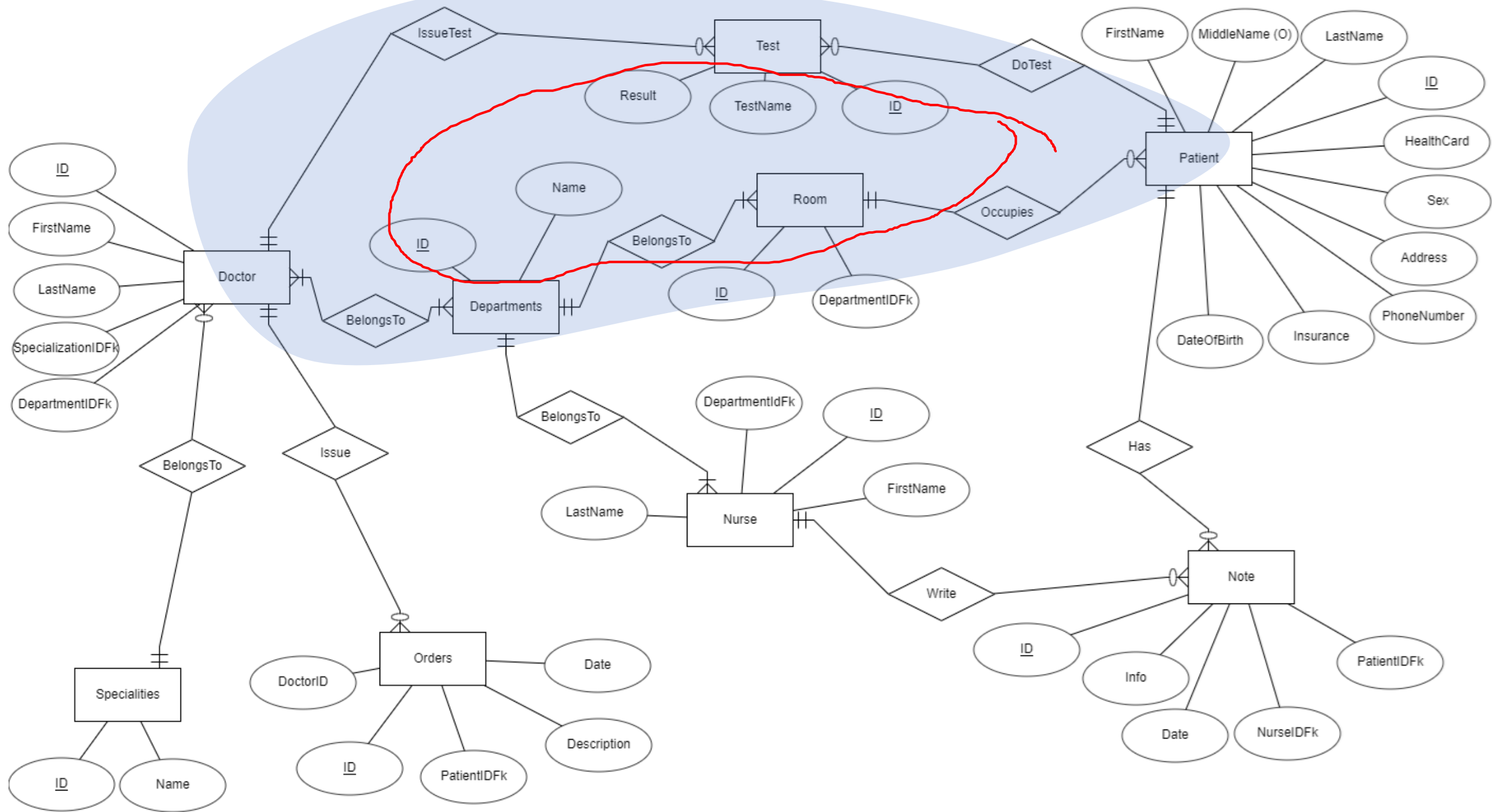


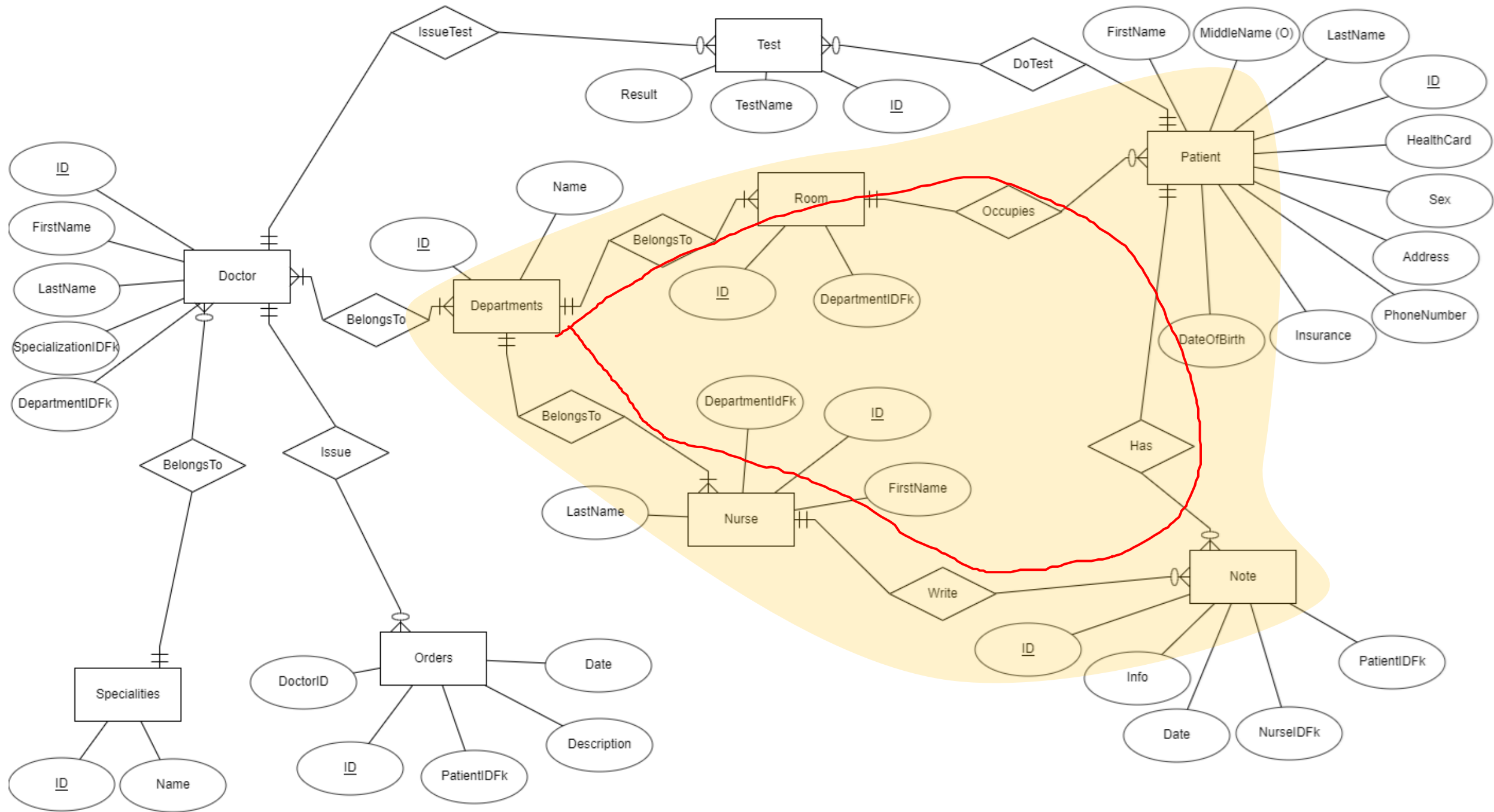


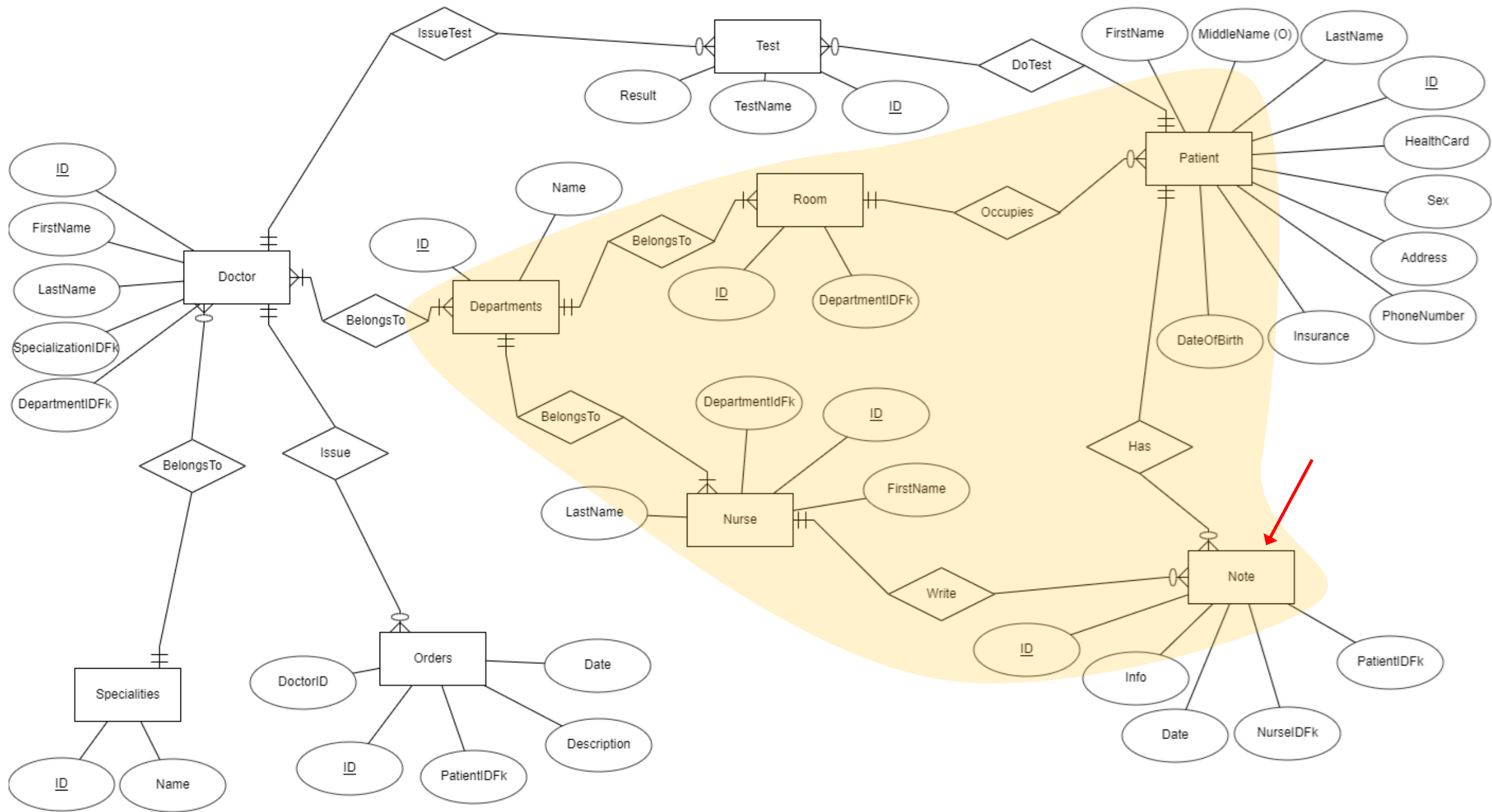
Might not be in any room!
E.g., Leaving the hospital.

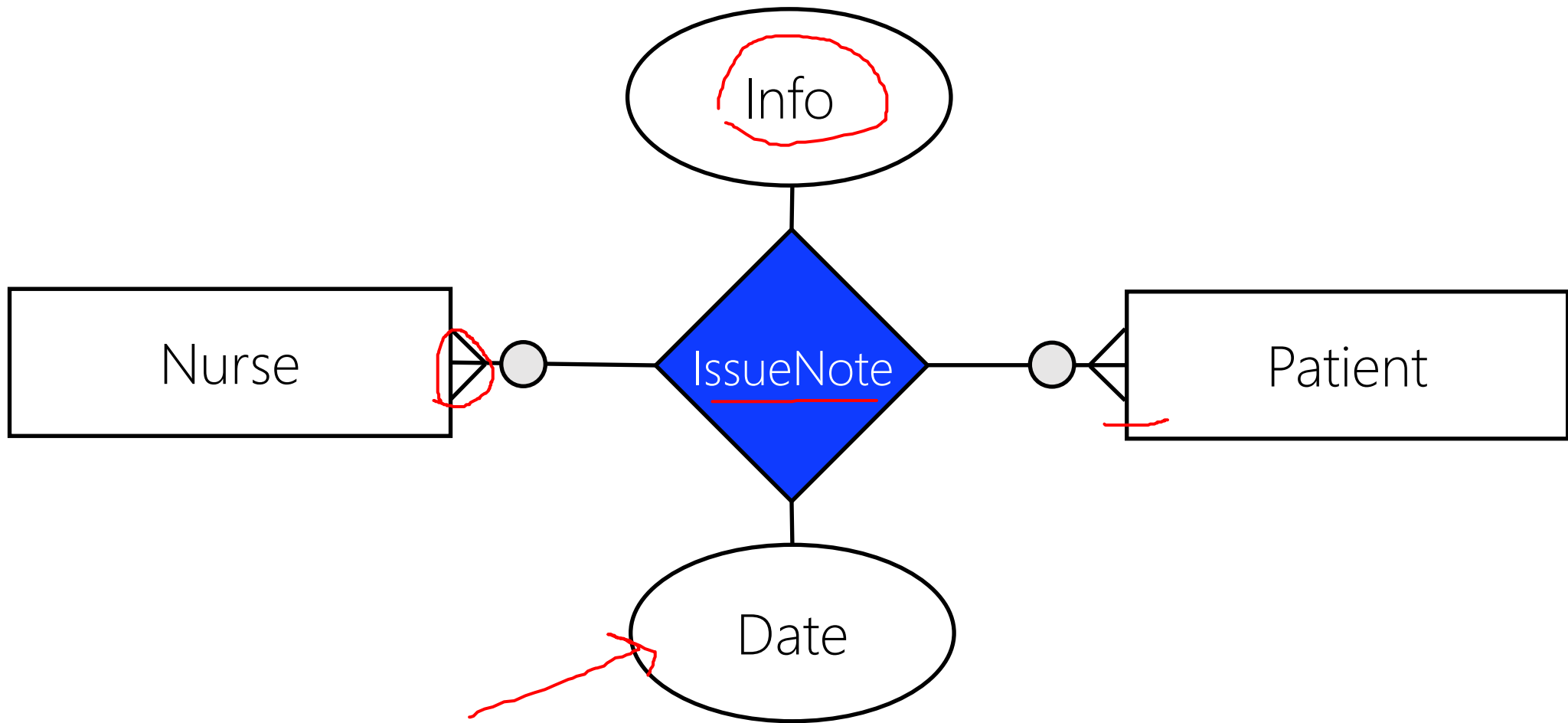
Might be in different rooms!
Misses StartDate & EndDate

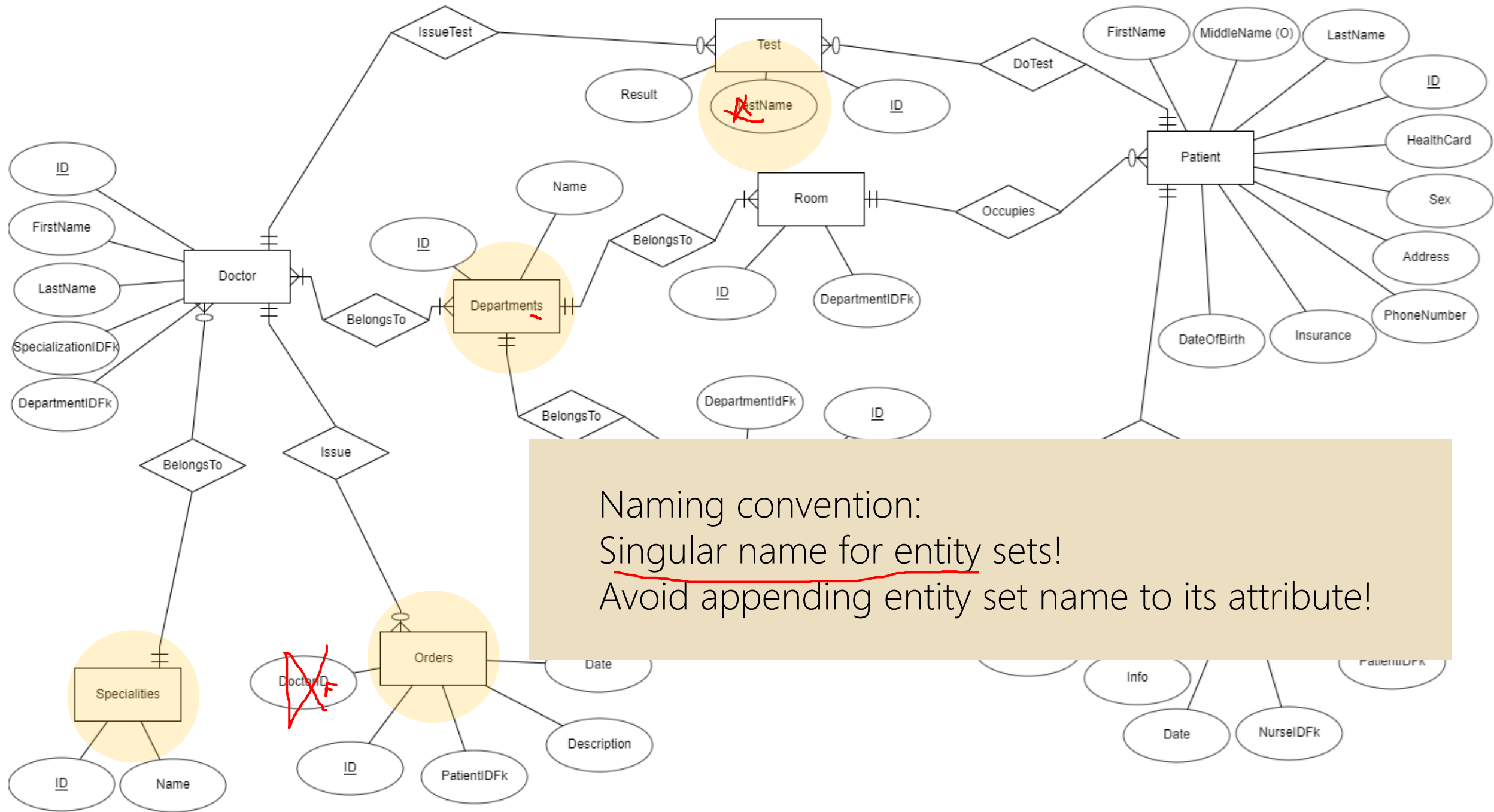


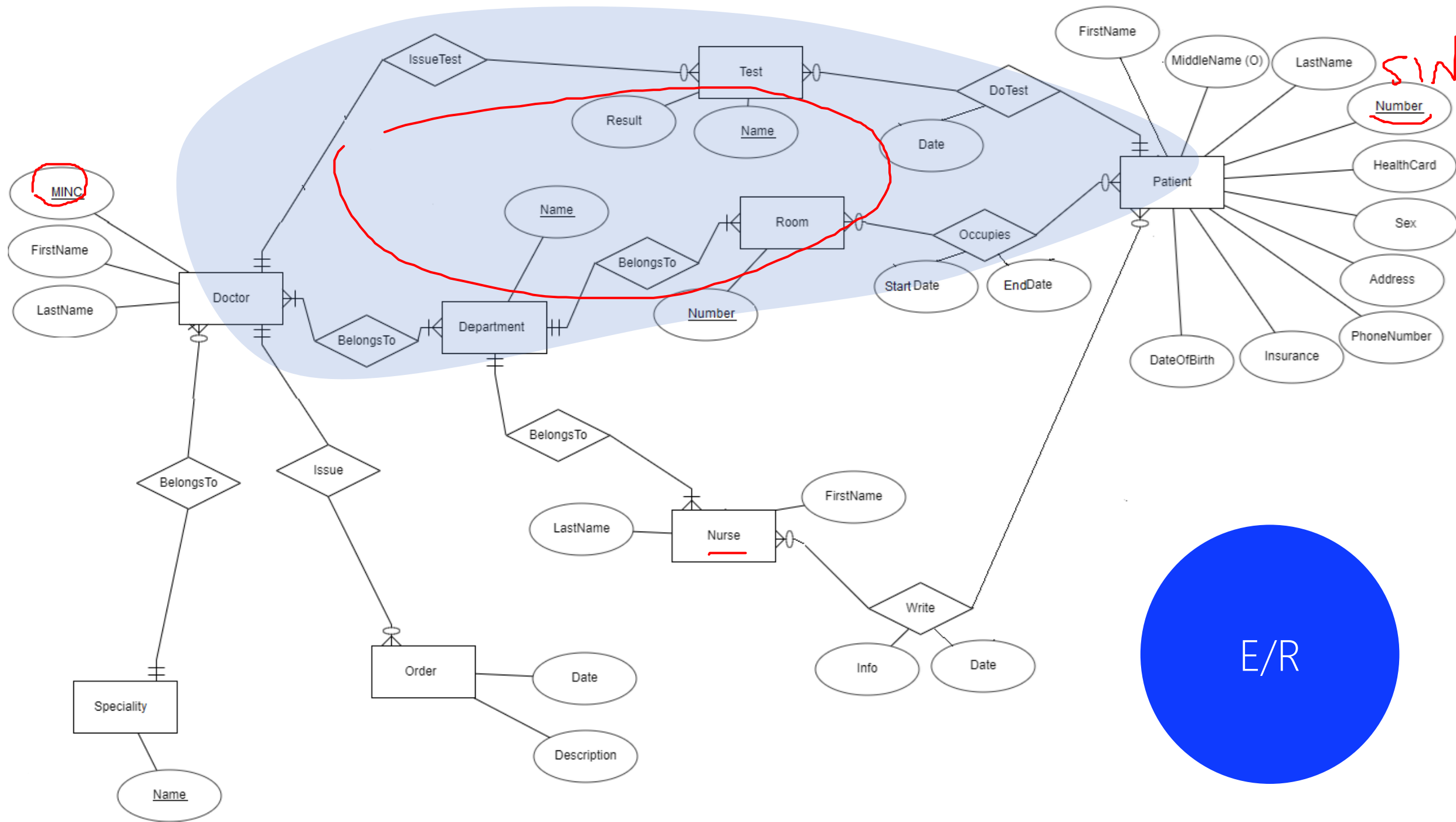














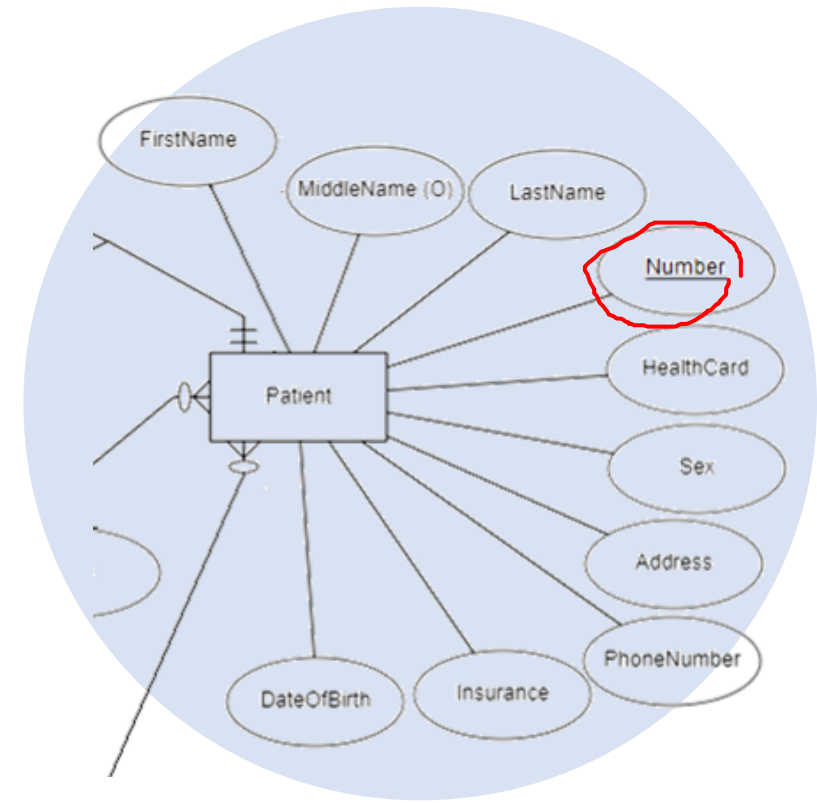
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Hospital × Relational Mapping

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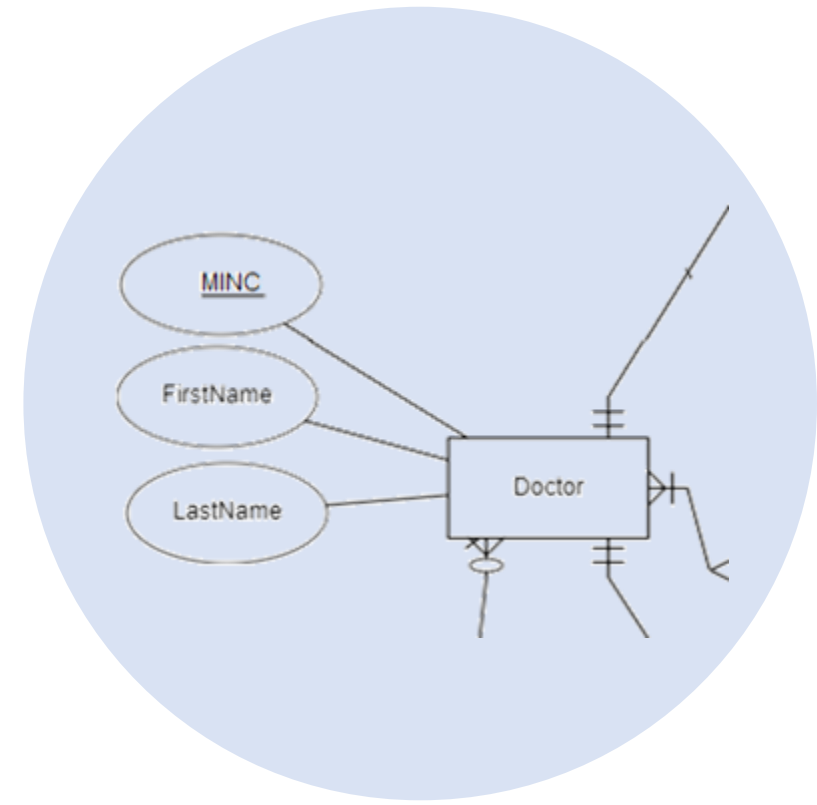
R1: Patient(Id,
Number,
FirstName,
MiddleName,
LastName,
Sex,
DateOfBirth,
Address,
Phone,
HealthCardNo,
InsuranceName)

CK={Number} & Mandatory



R2: Doctor(Id,
MINC,
FirstName,
LastName)

CK={MINC} & Mandatory



R3: Room(Id, Number)
CK={Number} & Mandatory

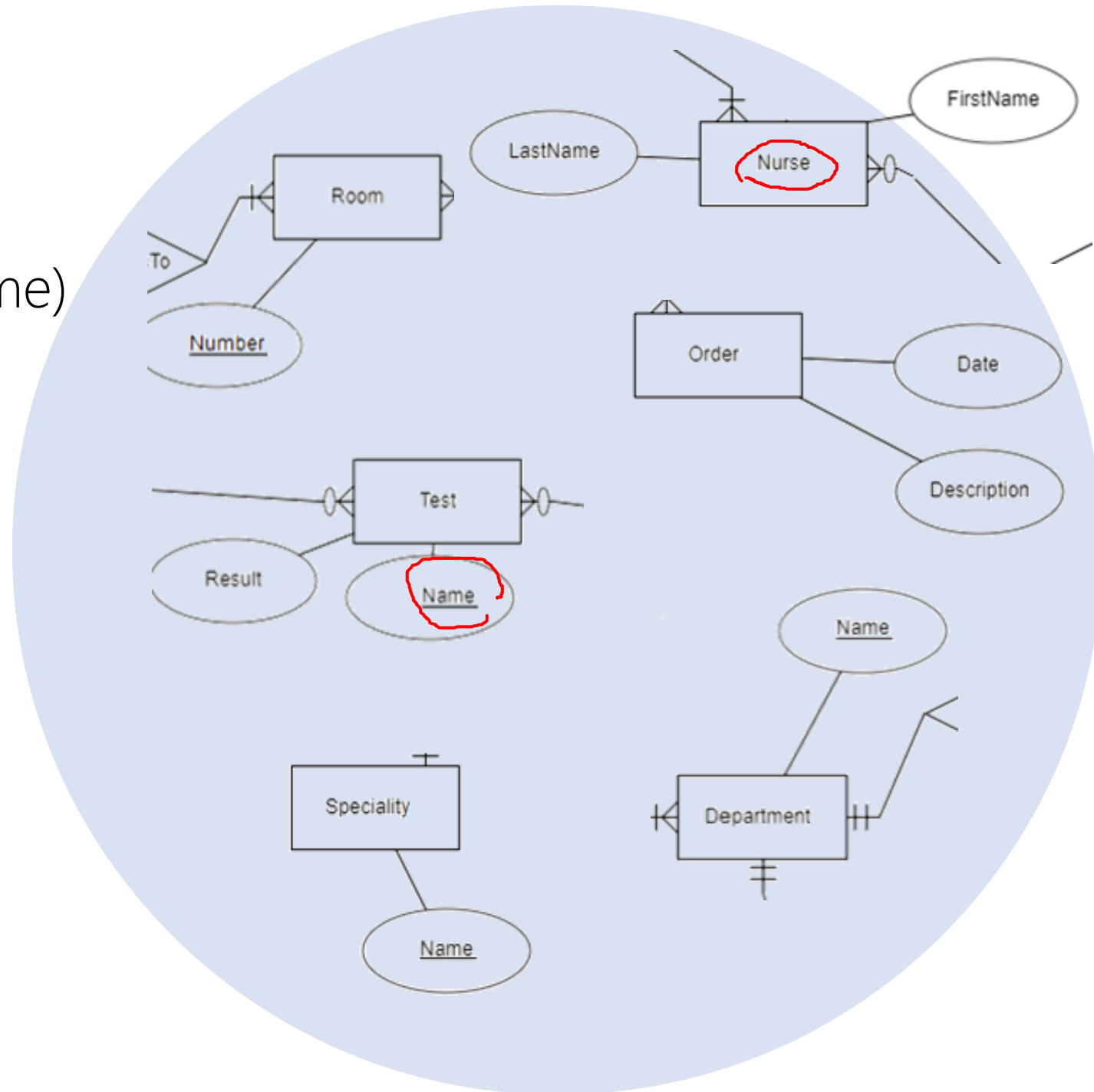
R4: Nurse(Id, FirstName, LastName)

R5: Test(Id, Name, Result)
CK={Name} & Mandatory

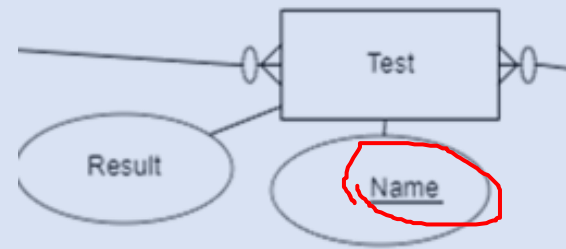
R6: Order(Id, Description, Date)

R7: Specialty(Id, Name)
CK={Name} & Mandatory

R8: Department(Id, Name)
CK={Name} & Mandatory



1 BT
R5: Test(Id, Name, Result)
CK={Name} & Mandatory



Result exist when a patient does a Test!
It should be on a relationship between Test and Patient

R9: PatientRoom(Id,
PatientId,
RoomId,
StartDate,
EndDate)

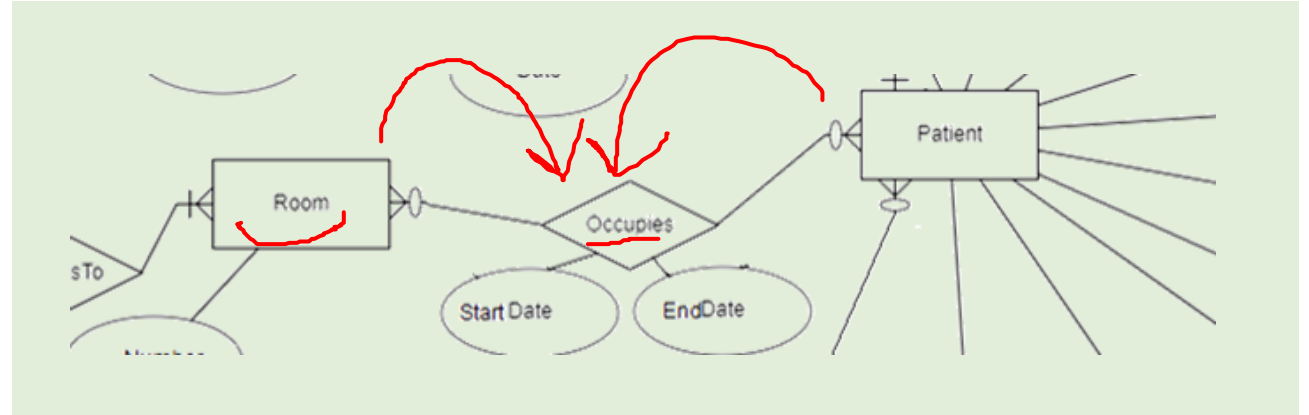
FK1={PatientId}

FK2={RoomId}

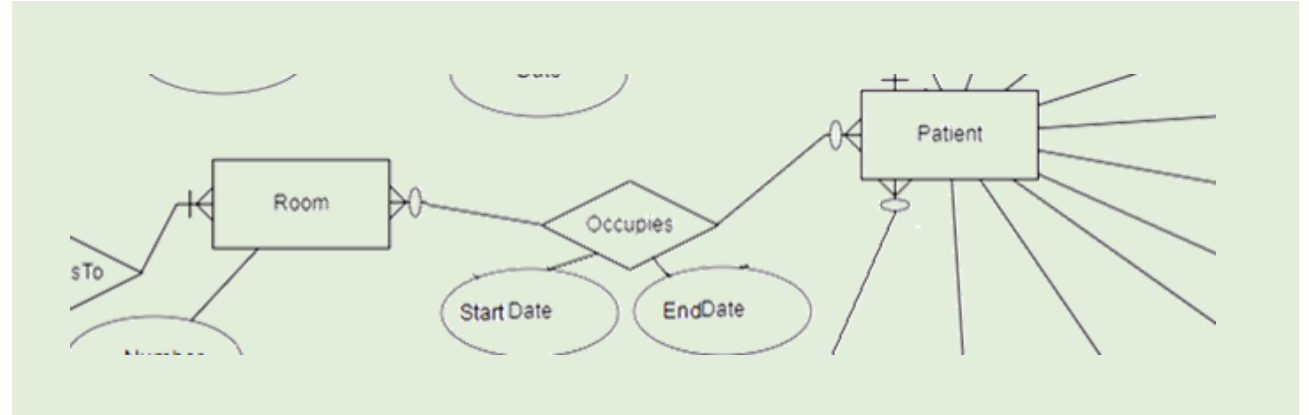
CK={PatientId, RoomId}

/

/



R9: PatientRoom(Id,
PatientId,
RoomId,
StartDate,
EndDate)



FK1={PatientId}

FK2={RoomId}

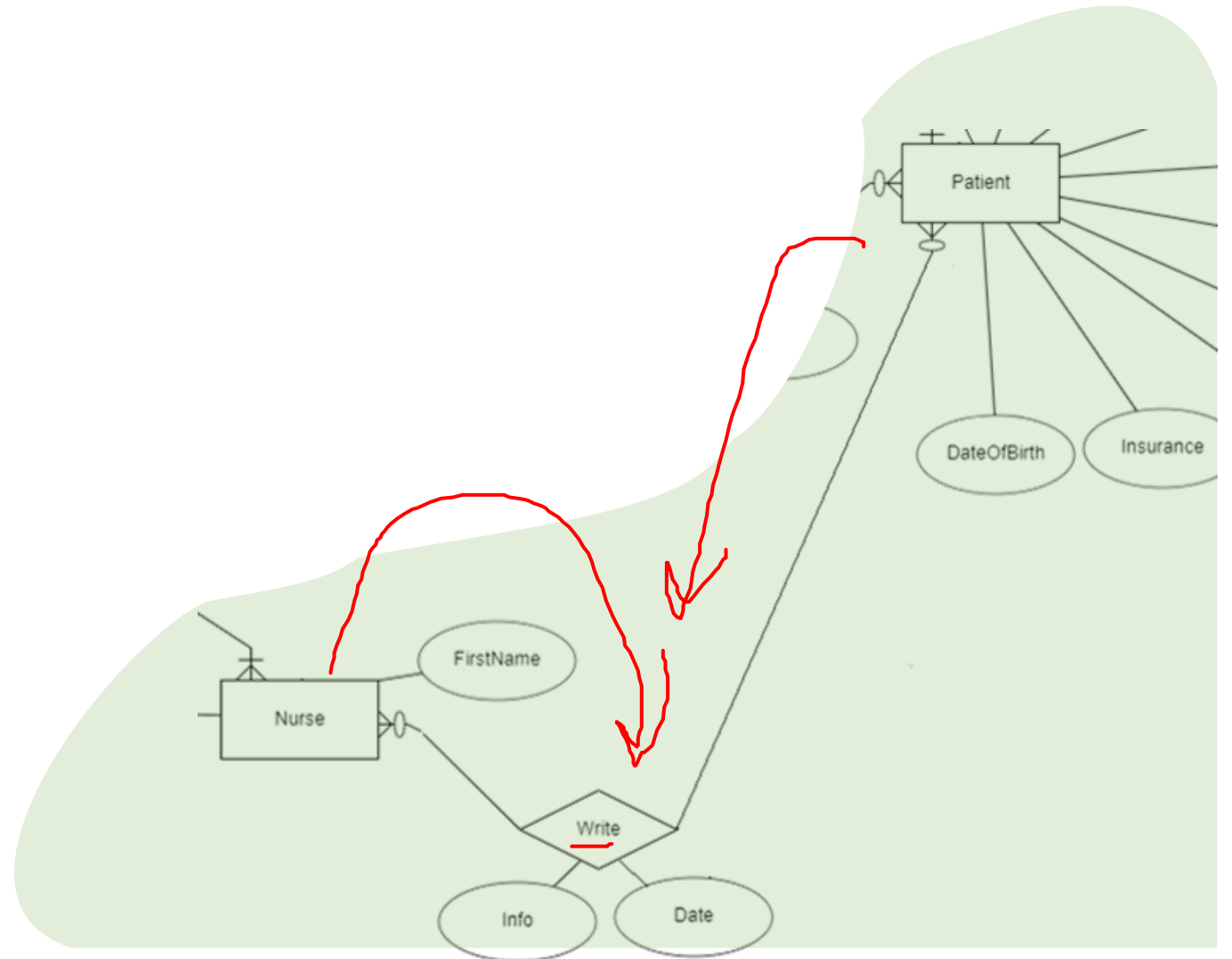
CK={PatientId, RoomId} U {StartDate} (Why?)

R10: PatientNurse(Id,
PatientId,
NurseId,
Date,
Info)

FK1={PatientId}

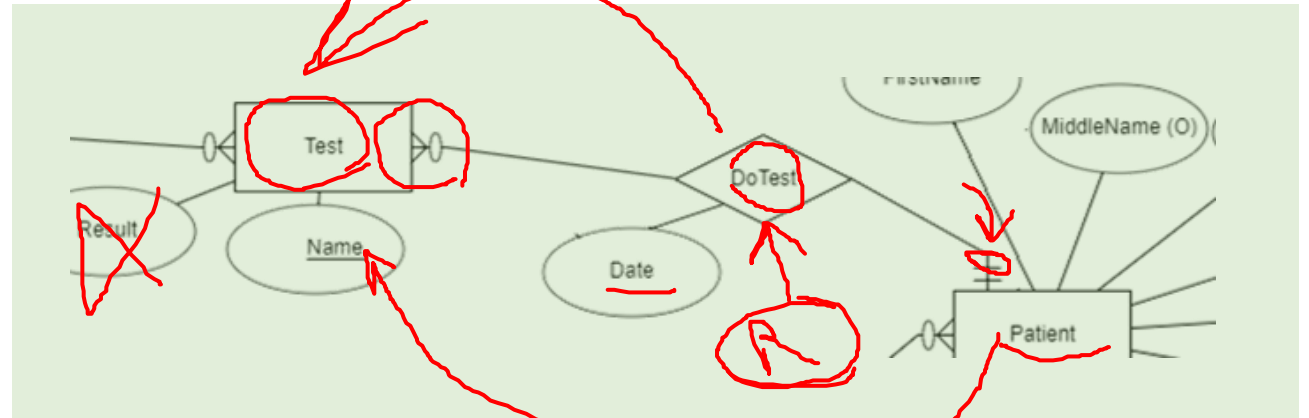
FK2={NurseId}

CK={PatientId, NurseId, Date}

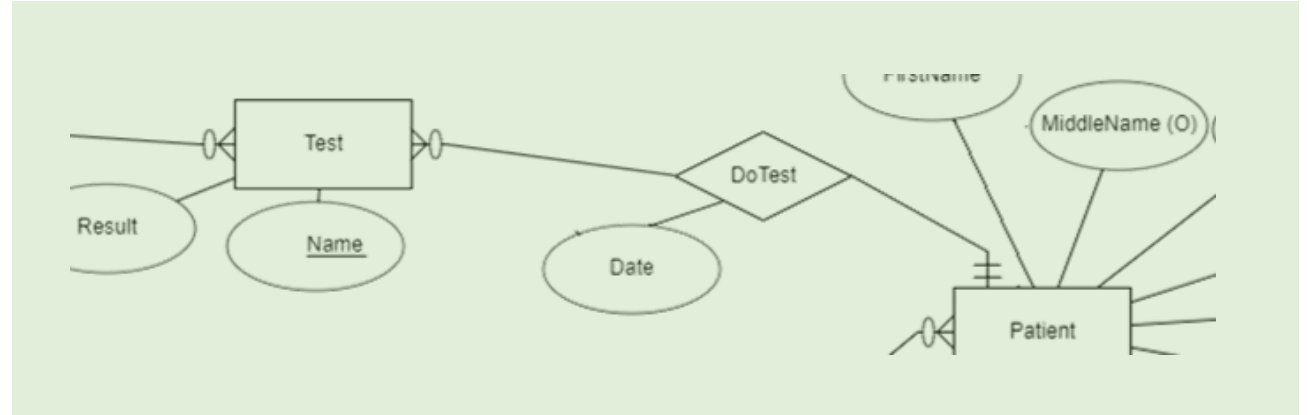


R5: Test(Id,
Name,
Result,
PatientId,
Date)

CK={Name} & Mandatory
FK={PatientId} & Mandatory



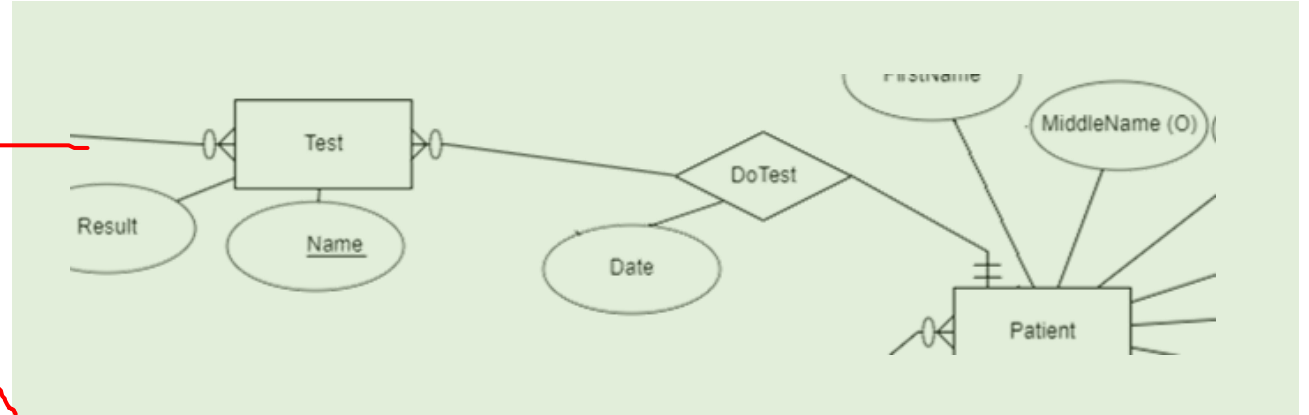
R5: Test(<u>Id</u> ,	1	2	3
Name,	BT	BT	WV
Result	R ₁	R ₂	R ₃
PatientId,	1	2	1
Date)	d ₁	d ₁	d ₁



CK={Name} & Mandatory
 FK={PatientId} & Mandatory

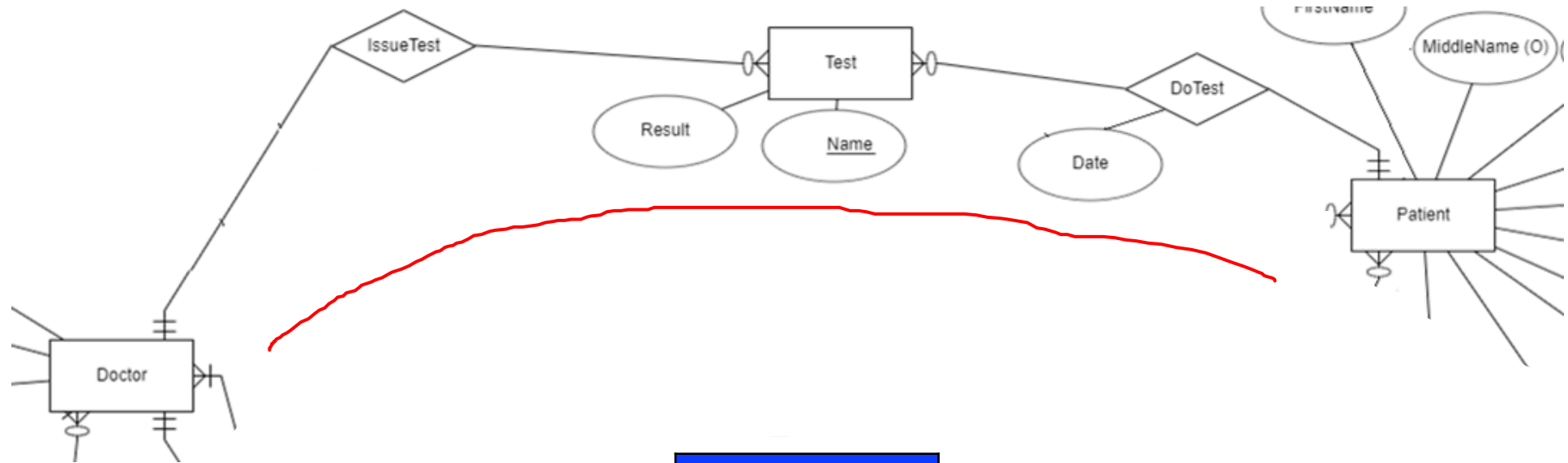
Wait! There is a problem here!

R5: Test(Id,
Name,
Result
PatientId,
Date)

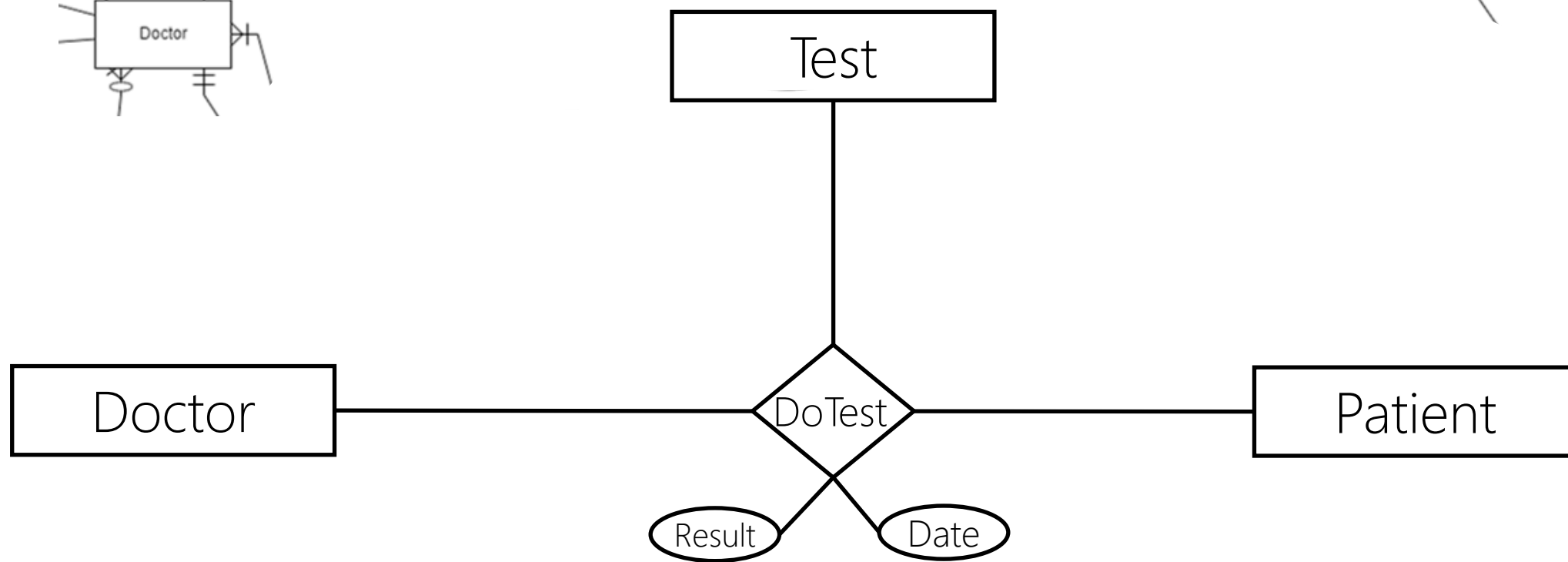
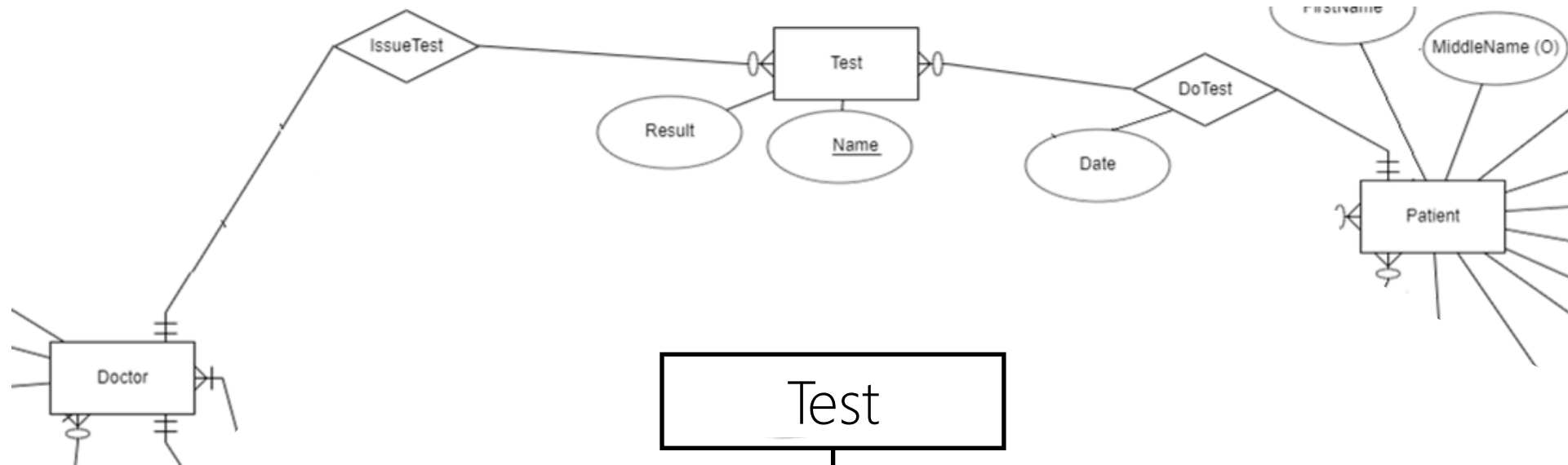


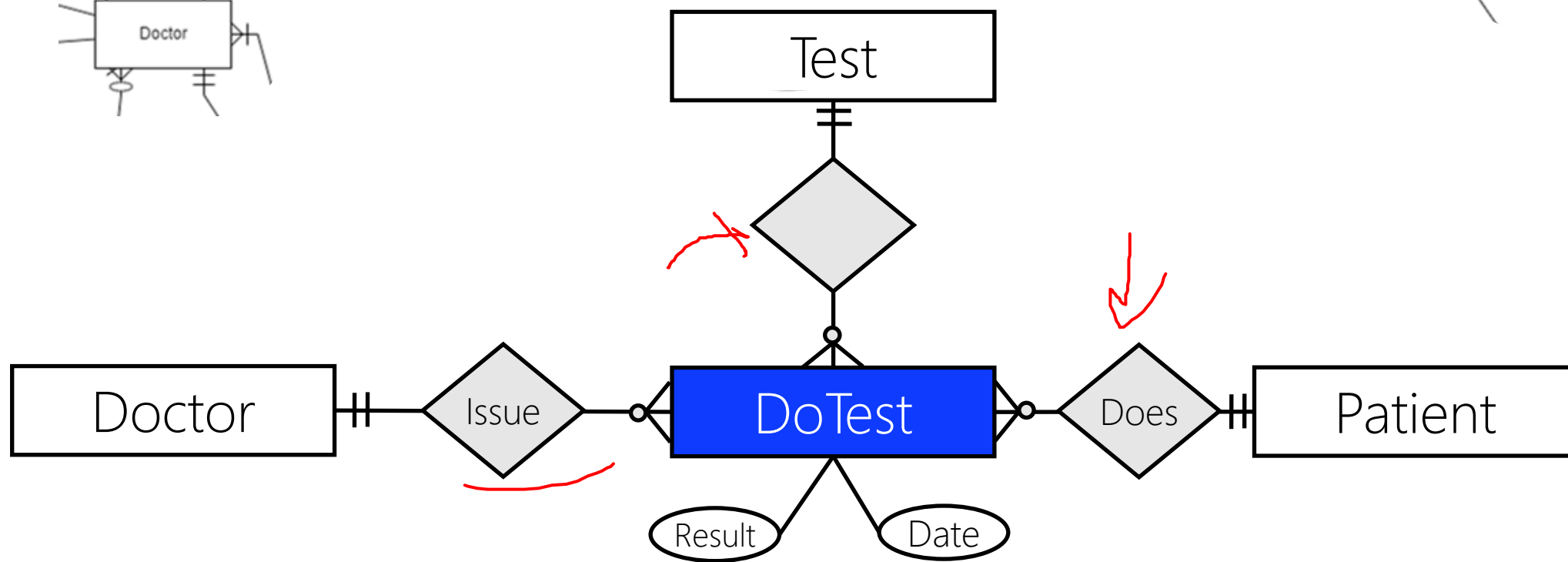
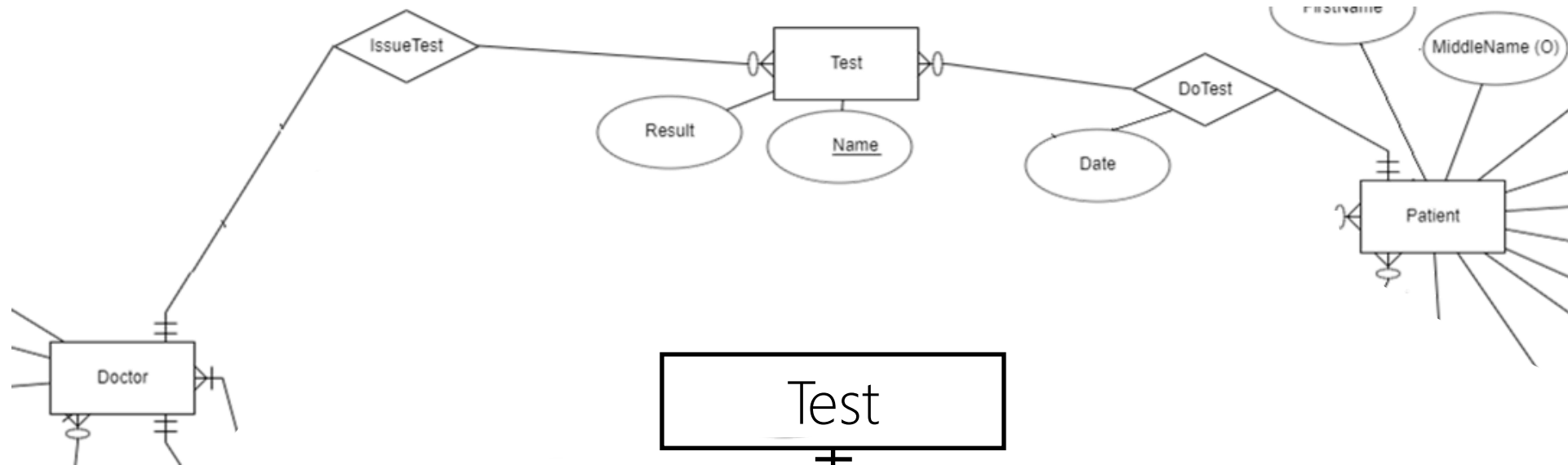
CK={Name} & Mandatory
FK={PatientId} & Mandatory

Wait! There is a problem here!
Each test can be done at most by one Patient!
Let's review Doctor, Test, Patient relationships ...

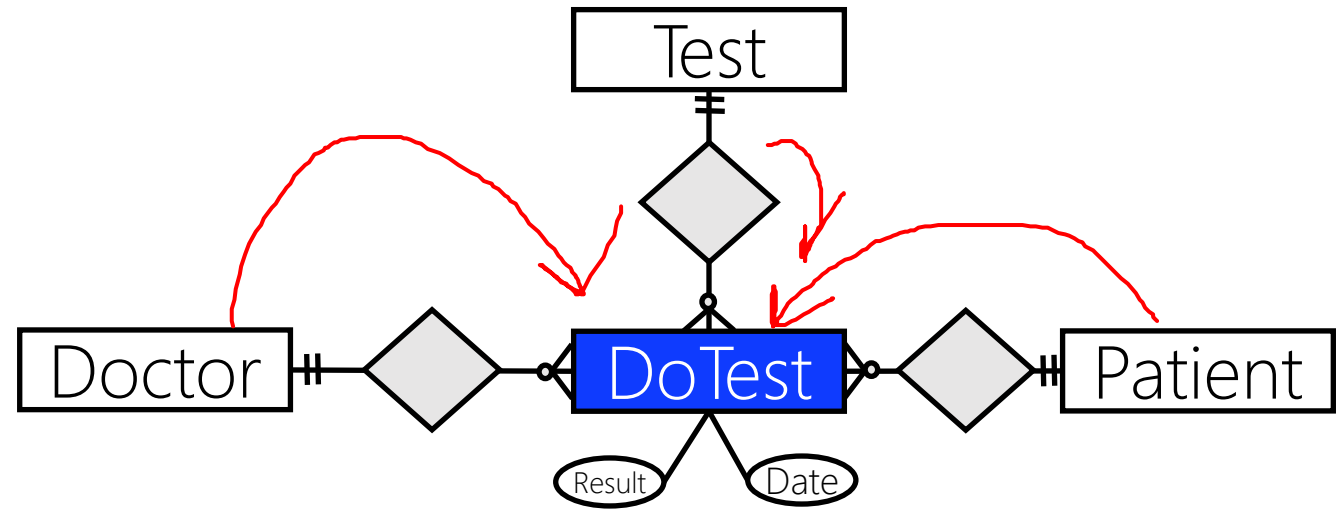


Doctor Entity Set		DoTest					Patient Entity Set	
d1		d1	p1	t1	r1	Fri.	p1	
d2		d1	p1	t2	r2	Fri.	p2	
		d2	p1	t3	r3	Tue.		





R5: Test(Id, Name,
~~Result~~,
~~PatientId~~,
~~Date~~)



CK={Name} & Mandatory

~~FK={PatientId} & Mandatory~~

R11: DoTest(Id, DoctorId, PatientId, TestId, Result, Date)

FK1={PatientId} & Mandatory

FK2={DoctorId} & Mandatory

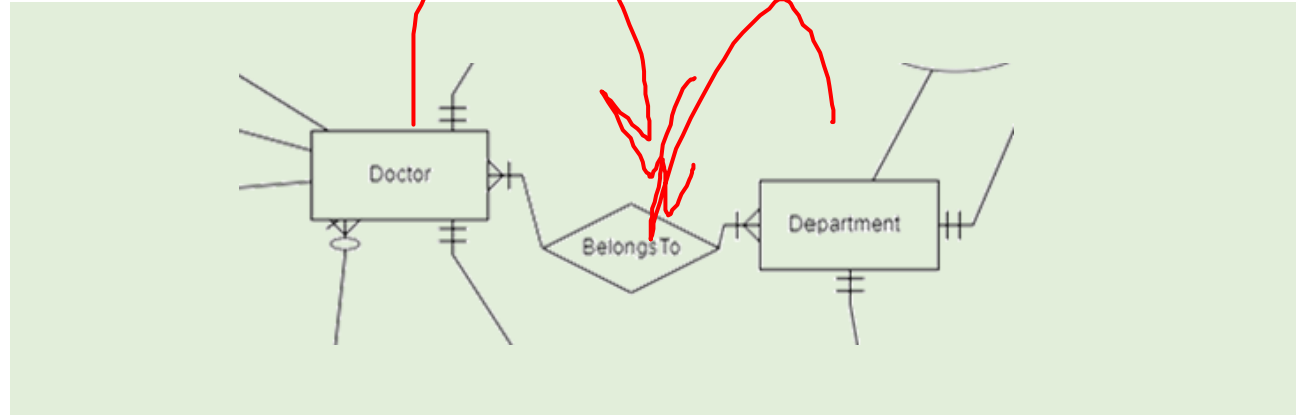
FK3={TestId} & Mandatory

R12: DoctorDepartment(Id, DoctorId, DepartmentId)

FK1={DoctorId}

FK2={DepartmentId}

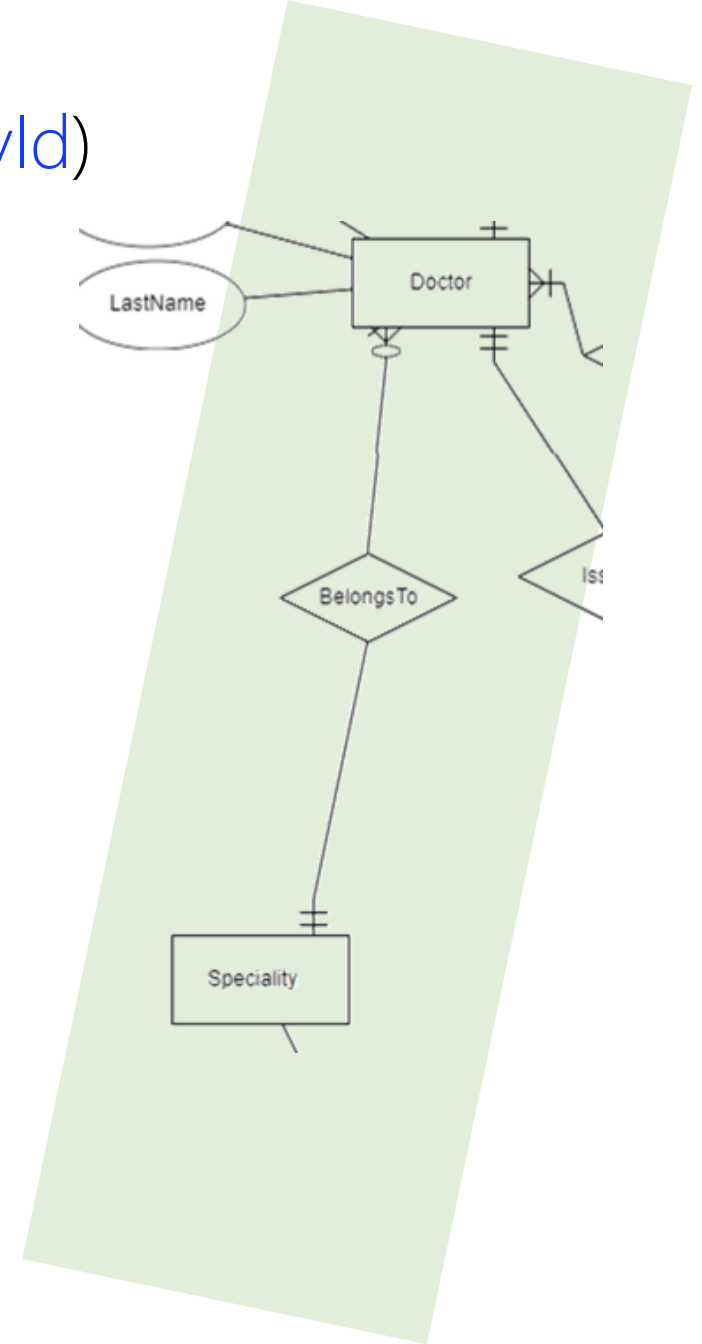
CK={DoctorId, DepartmentId}



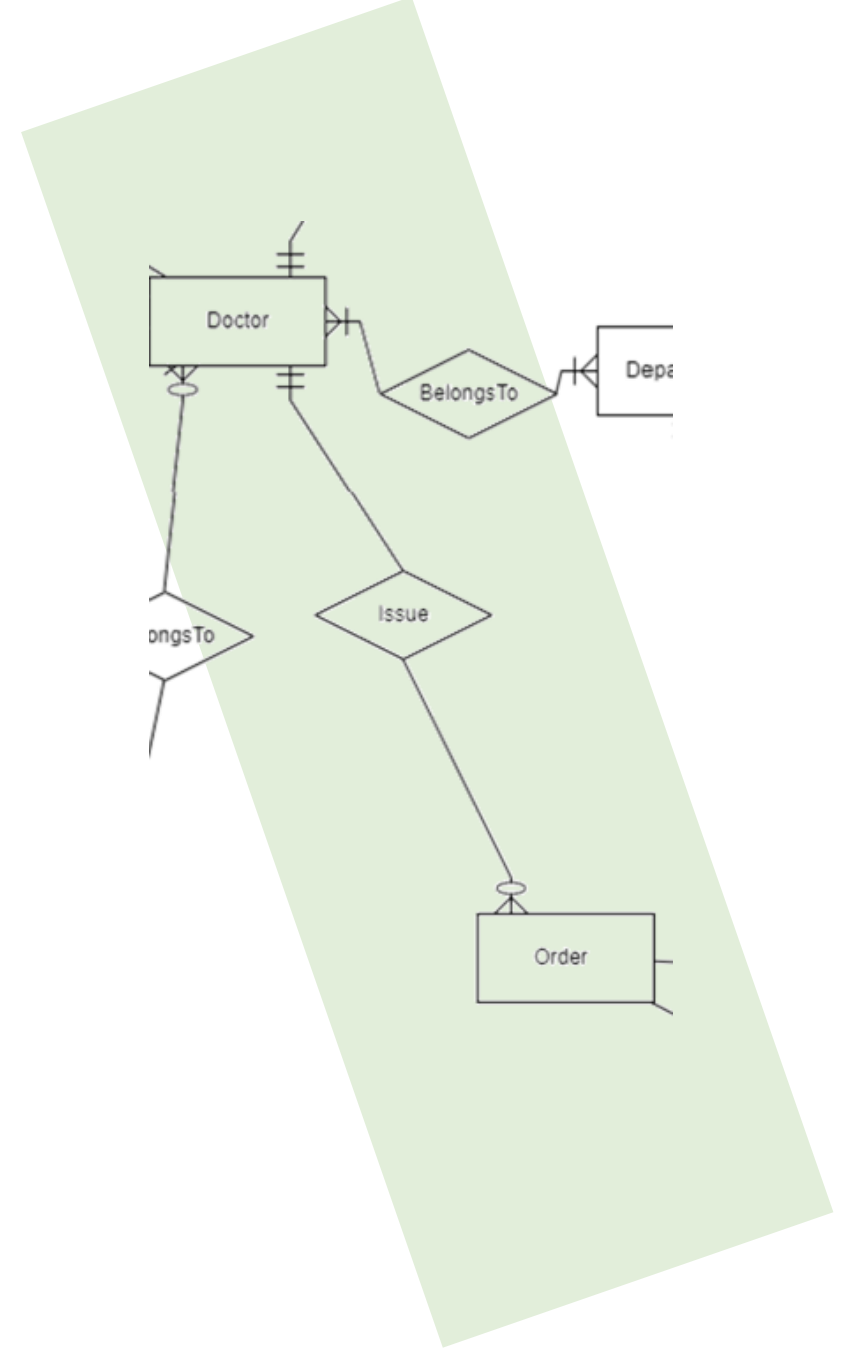
R2: Doctor(Id, MINC, FirstName, LastName, SpecialtyId)

CK={MINC} & Mandatory

FK={SpecialtyId} & Mandatory



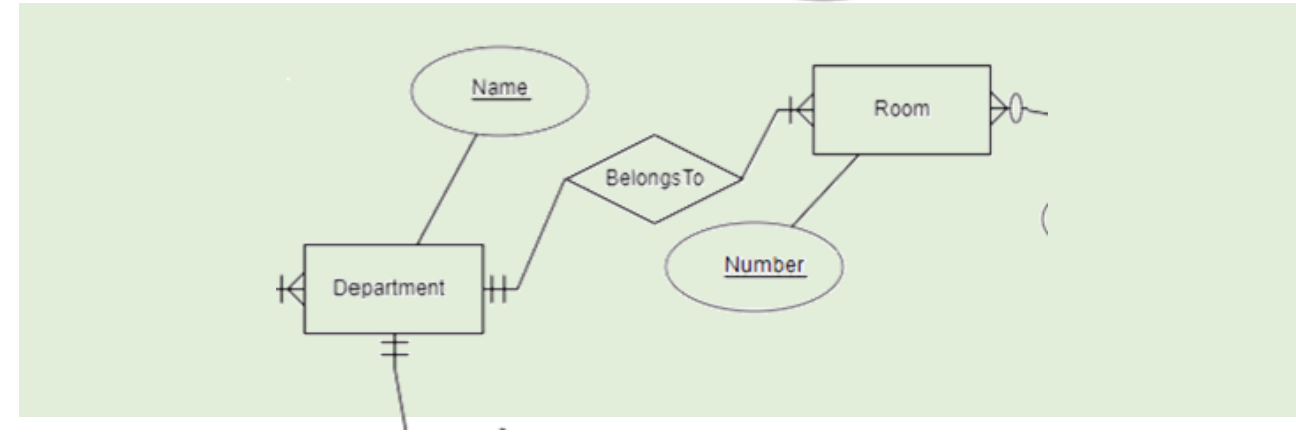
R6: Order(Id, Description, Date, DoctorId)
FK={DoctorId} & Mandatory



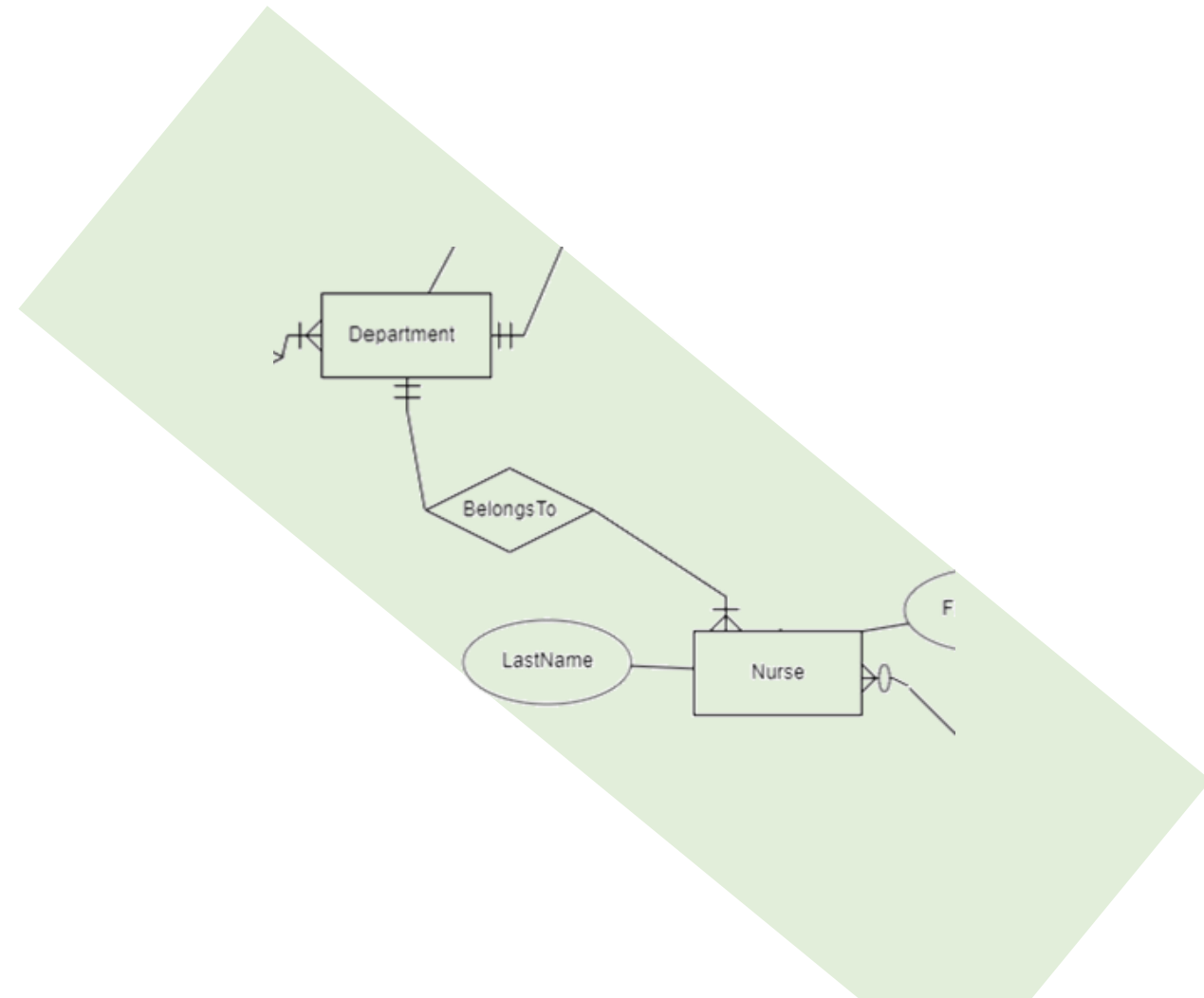
R3: Room(Id, Number, DepartmentId)

CK={Number} & Mandatory

FK={DepartmentId} & Mandatory



R4: Nurse(Id, FirstName, LastName, DepartmentId)
FK={DepartmentId} & Mandatory



R1: Patient(Id, Number, FirstName, MiddleName, LastName, Sex, DateOfBirth, Address, Phone, HealthCardNo, InsuranceName), CK={Number} & Mandatory
R2: Doctor(Id, MINC, FirstName, LastName, SpecialtyId), CK={MINC} & Mandatory, FK={SpecialtyId} & Mandatory
R3: Room(Id, Number, DepartmentId), CK={Number} & Mandatory, FK={DepartmentId} & Mandatory
R4: Nurse(Id, FirstName, LastName, DepartmentId), FK={DepartmentId} & Mandatory
R5: Test(Id, Name), CK={Name} & Mandatory
R6: Order(Id, Description, Date, DoctorId), FK={DoctorId} & Mandatory
R7: Specialty(Id, Name), CK={Name} & Mandatory
R8: Department(Id, Name), CK={Name} & Mandatory
R9: PatientRoom(Id, PatientId, RoomId, StartDate, EndDate), FK1={PatientId}, FK2={RoomId}, CK={PatientId, RoomId, StartDate}
R10: PatientNurse(Id, PatientId, NurselId, Date, Info), FK1={PatientId}, FK2={NurselId}, CK={PatientId, NurselId, Date}
R11: DoTest(Id, DoctorId, PatientId, TestId, Result, Date), FK1={PatientId} & Mandatory, FK2={DoctorId} & Mandatory, FK3={PatientId} & Mandatory, CK={DoctorId, PatientId, TestId, Date}
R12: DoctorDepartment(Id, DoctorId, DepartmentId), FK1={DoctorId}, FK2={DepartmentId}, CK={DoctorId, DepartmentId}



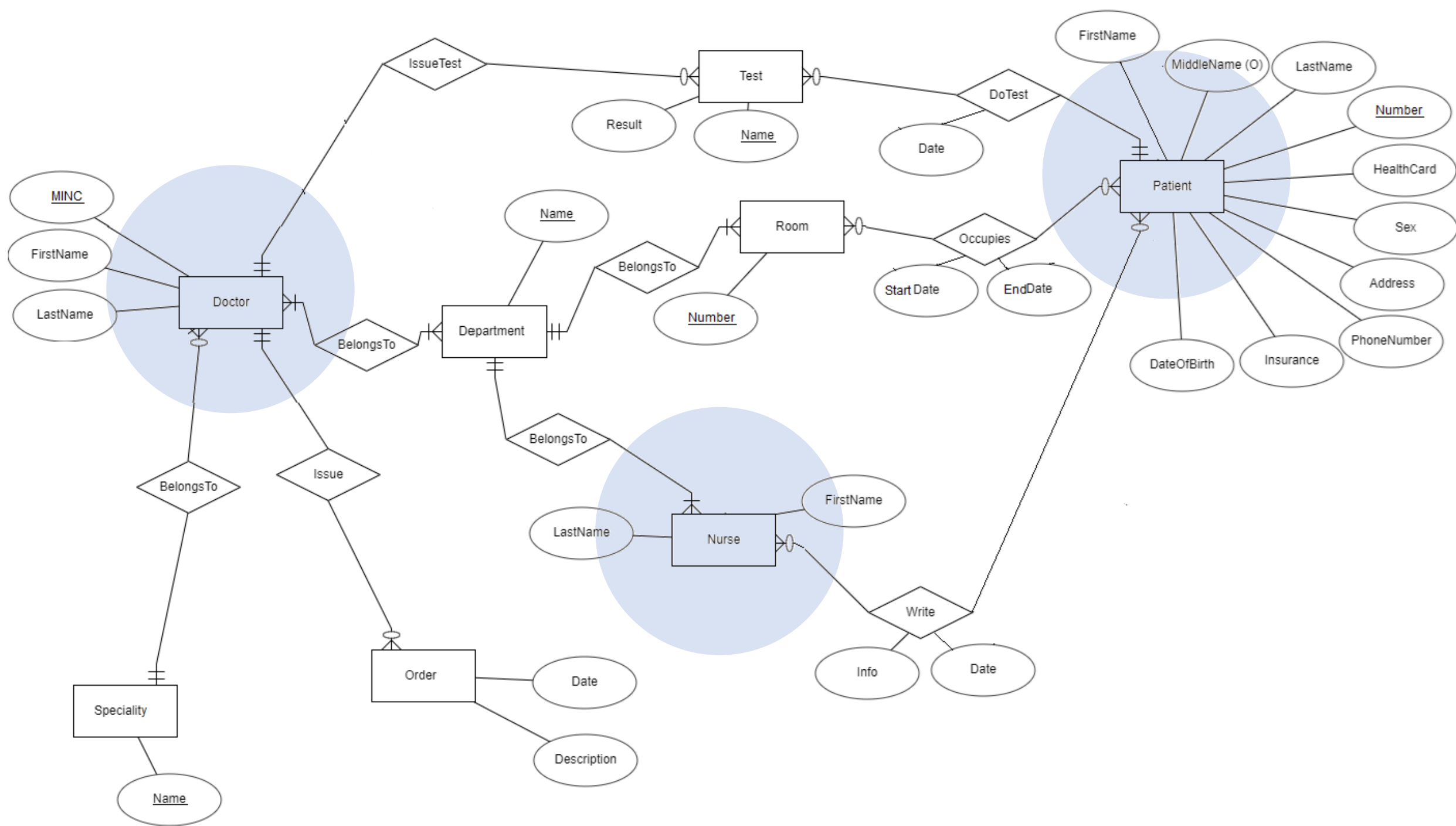
Relational

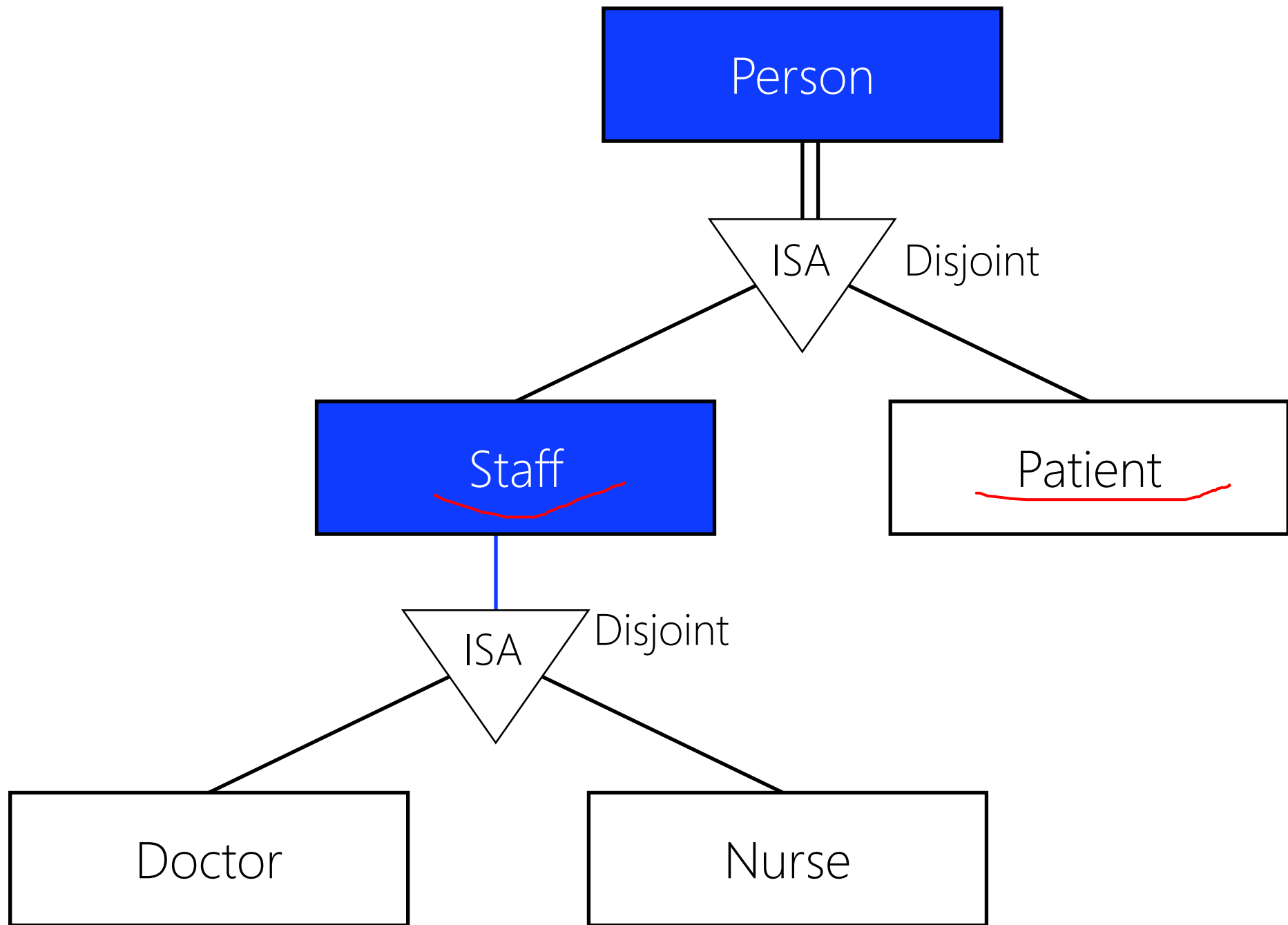


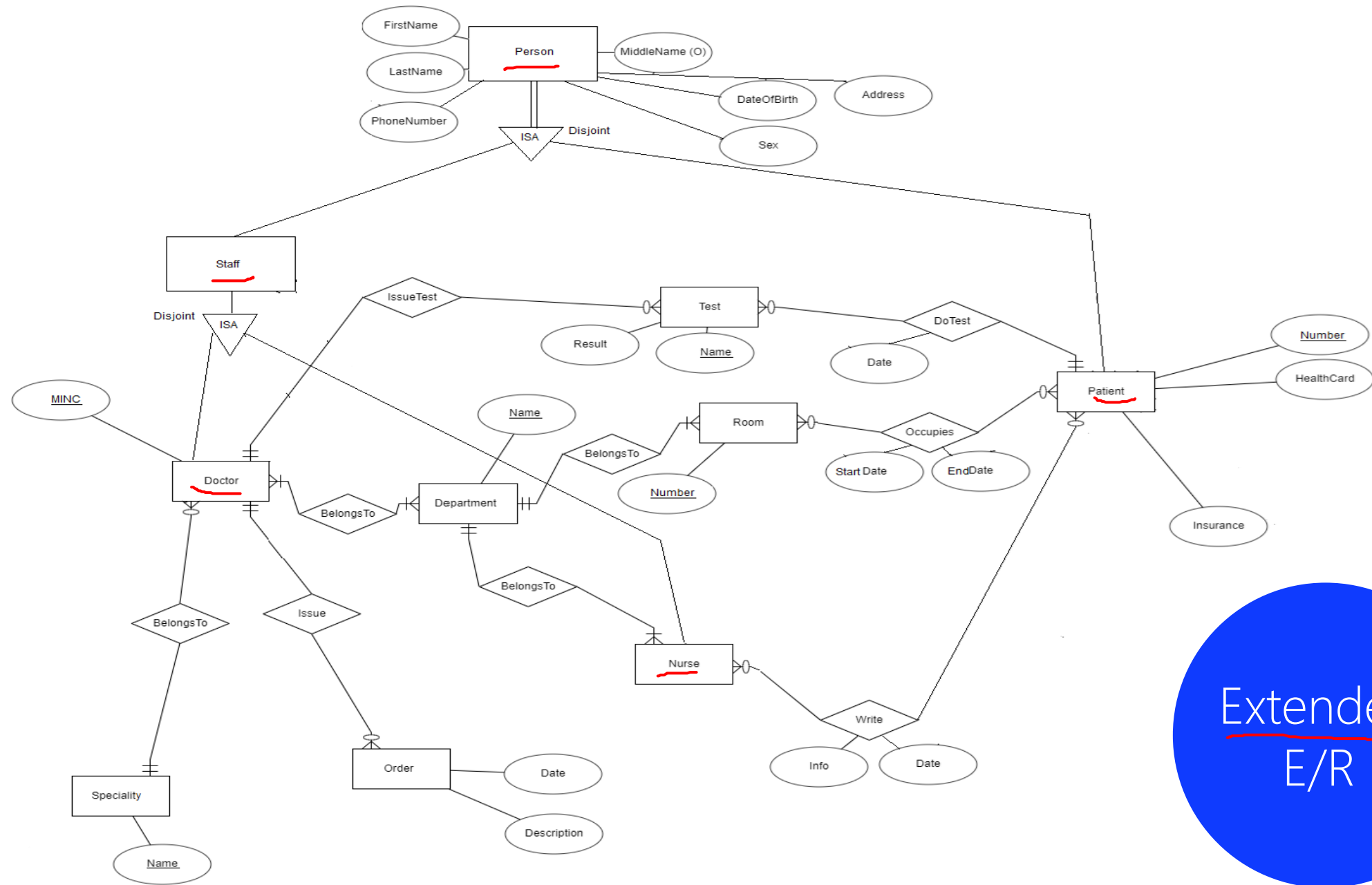
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Hospital × IS-A

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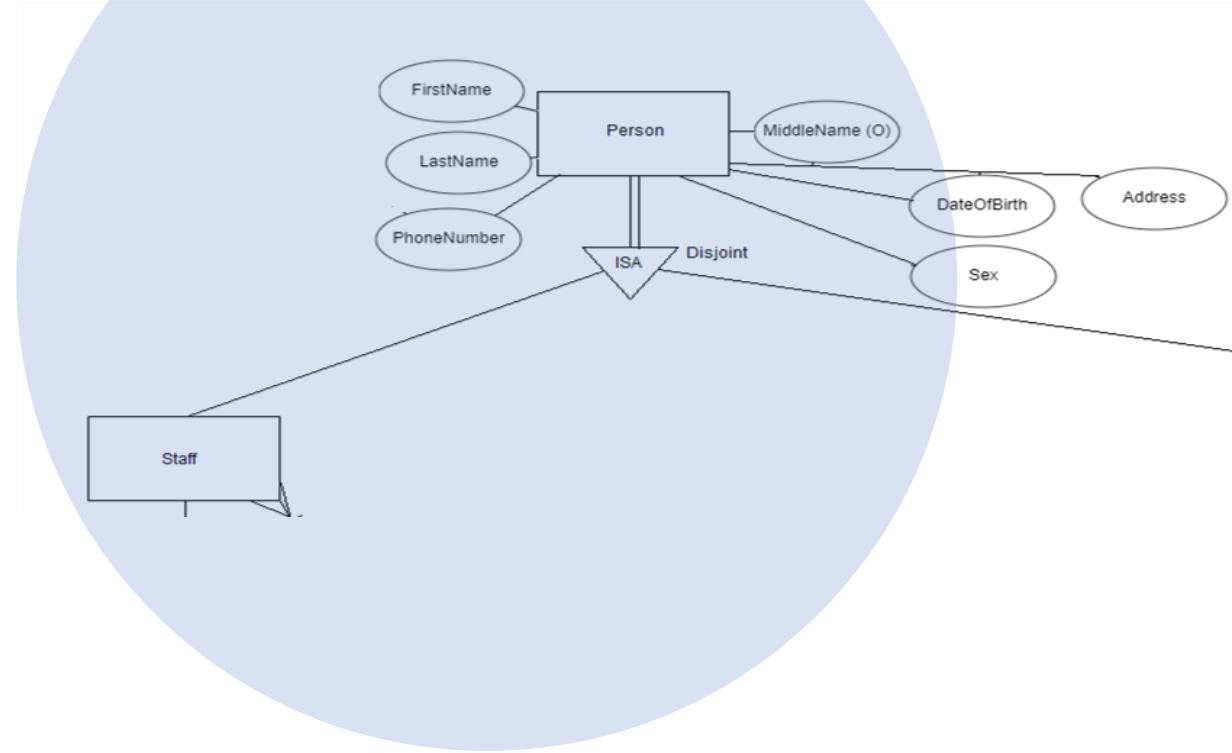
Extended
E/R

Hospital × IS-A Mapping

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R13: Person(Id)

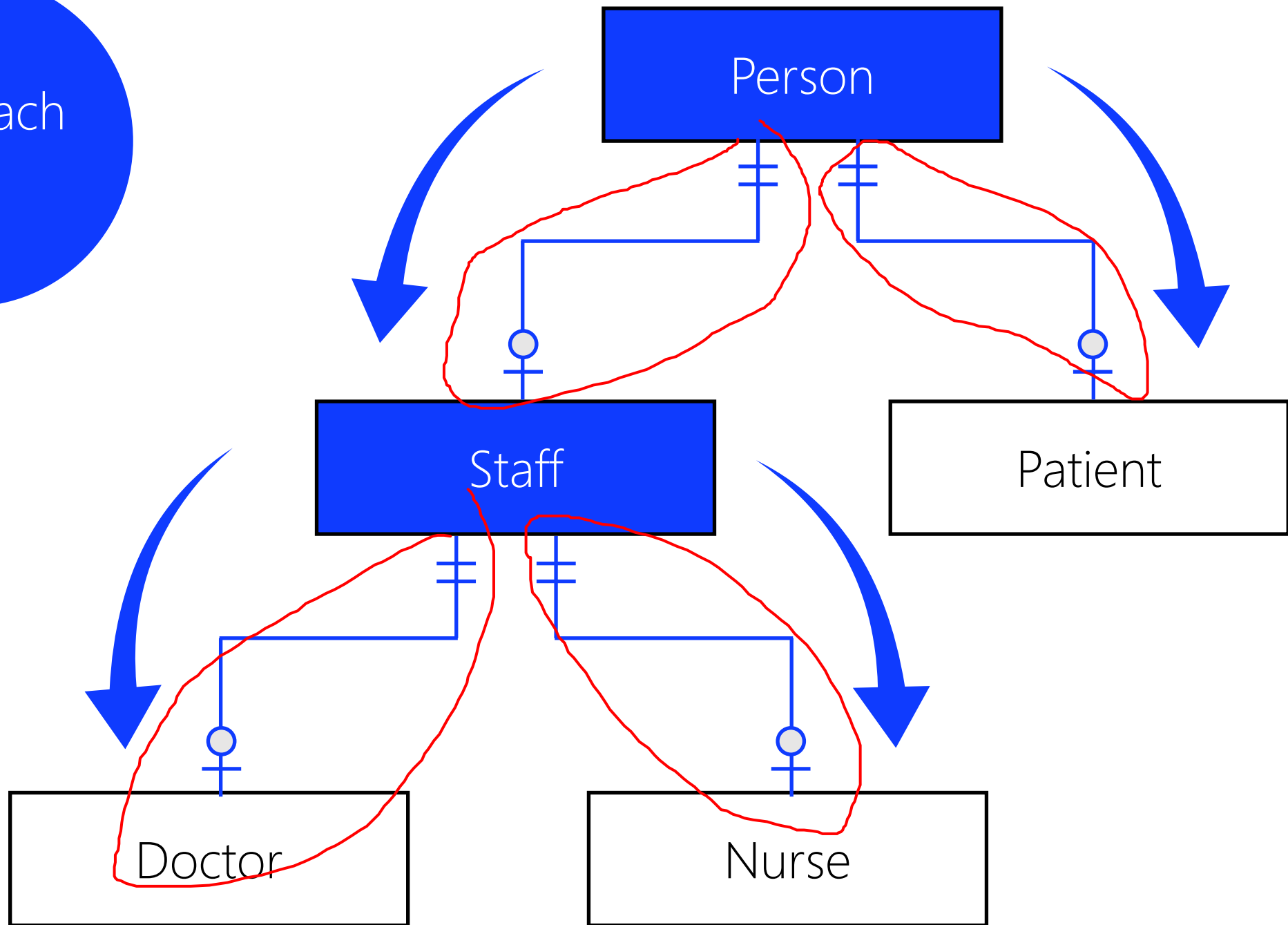
FirstName,
MiddleName,
LastName,
Sex,
DateOfBirth,
Address,
Phone)



R14: Staff(Id)

R1: Patient(Id, Number, HealthCardNo, InsuranceName), CK={Number} & Mandatory
R2: Doctor(Id, MINC, SpecialtyId), CK={MINC} & Mandatory, FK={SpecialtyId} & Mandatory
R4: Nurse(Id, DepartmentId), FK={DepartmentId} & Mandatory

Approach
III-a



R13: Person(Id, FirstName, MiddleName, LastName, Sex, DateOfBirth, Address, Phone)

R14: Staff(Id , PersonId)

FK={PersonId}, CK2={PersonId} & Mandatory

R1: Patient(Id, Number, HealthCardNo, InsuranceName, PersonId)

CK1={Number} & Mandatory

FK={PersonId}, CK2={PersonId} & Mandatory

R2: Doctor(Id, MINC, SpecialtyId, StaffId),

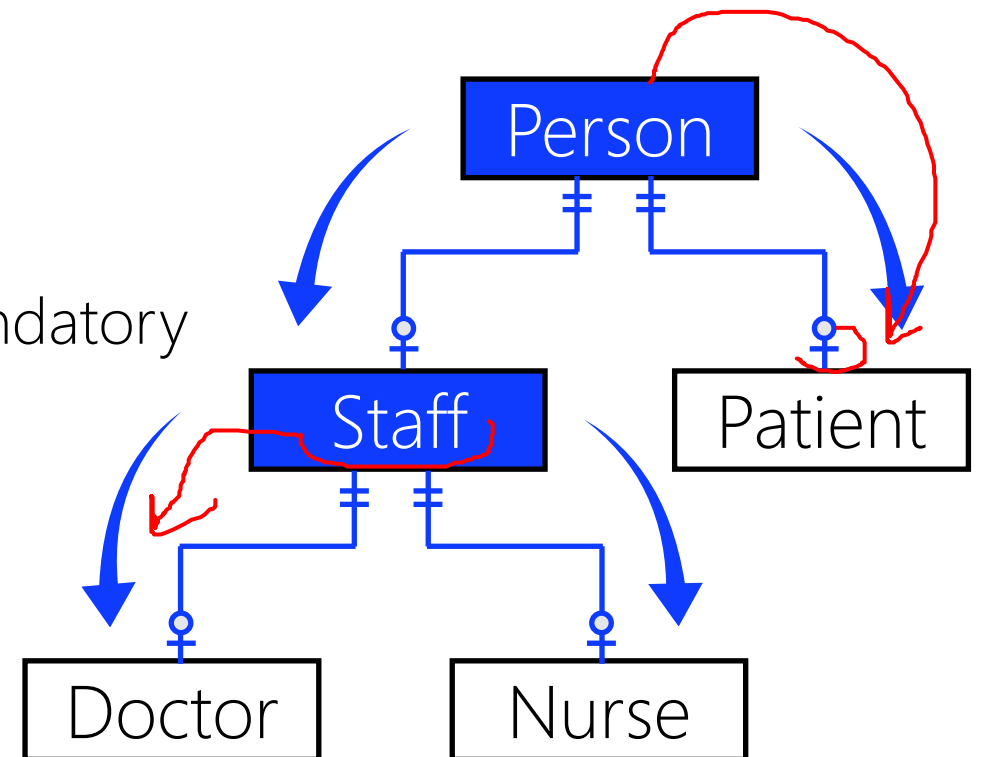
CK1={MINC} & Mandatory, FK1={SpecialtyId} & Mandatory

FK2={StaffId}, CK2={StaffId} & Mandatory

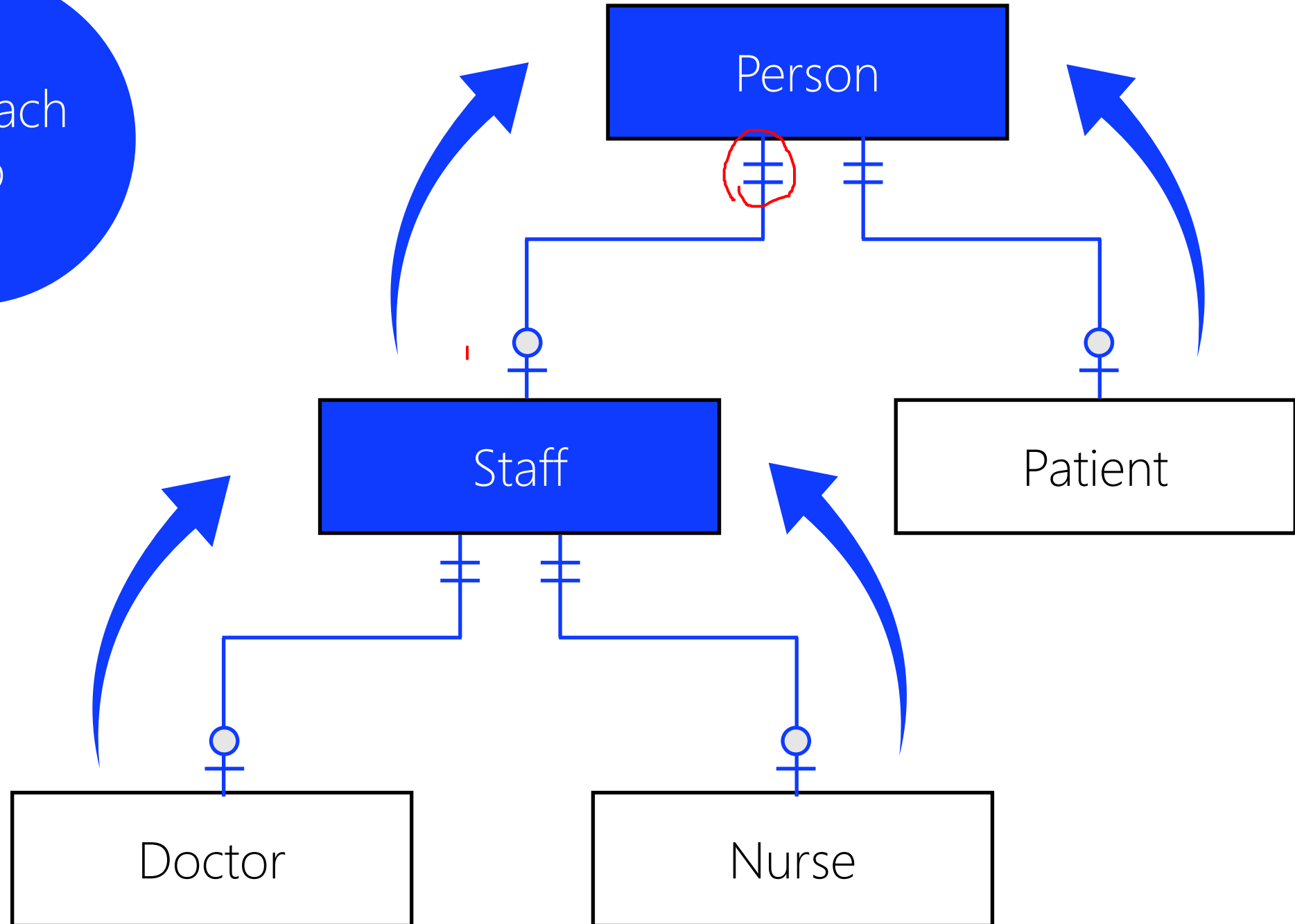
R4: Nurse(Id, DepartmentId, StaffId)

FK1={DepartmentId} & Mandatory

FK2={StaffId}, CK={StaffId} & Mandatory



Approach
III-b



R13: Person(Id, FirstName, MiddleName, LastName, Sex, DateOfBirth,

R1: Patient(Address,

R1: Patient(Phone,

R1: Patient(StaffId, ←

R1: Patient(PatientId) ←

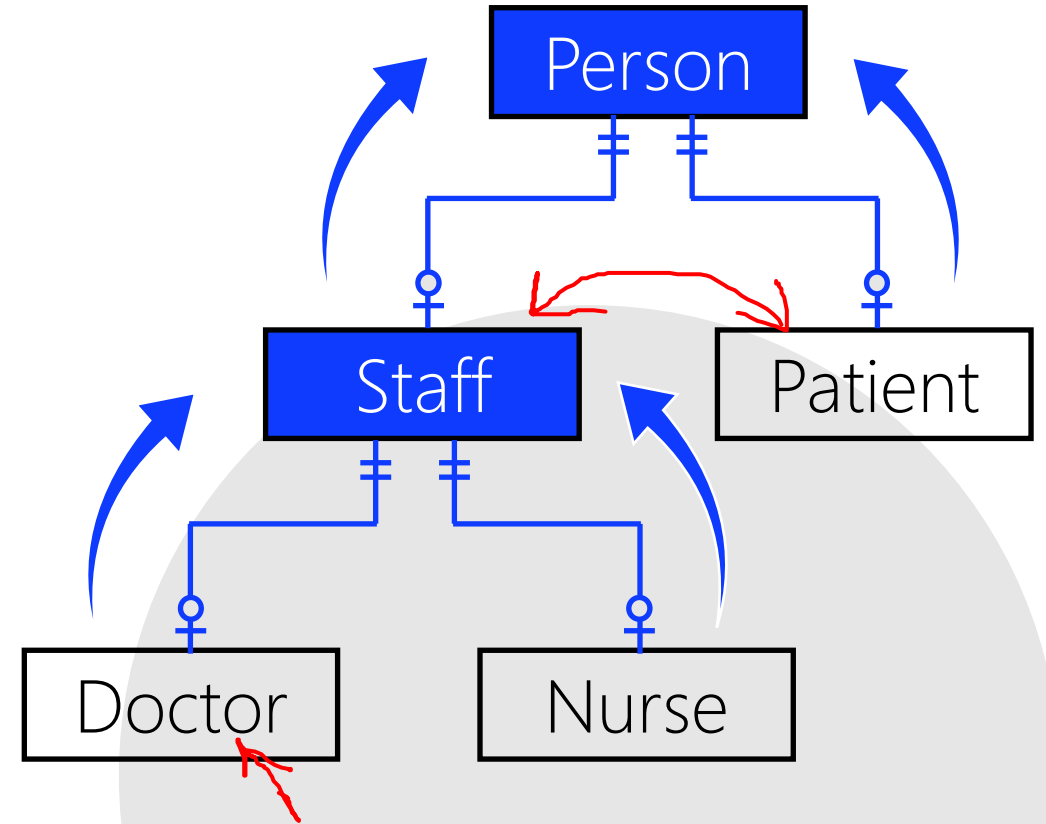
FK1={StaffId}, CK1={StaffId}

FK2={PatientId}, CK2={PatientId}

R14: Staff(Id, DoctorId, NurseId)

FK1={DoctorId}, CK1={DoctorId}

FK2={NurseId}, CK2={NurseId}



Must be optional. Cannot be Mandatory



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