Project for Database Design

Phase II. Relational Schema

Vinit Patel   Madhav Patel
Vnp130130@utdallas.edu   Mmp130630@utdallas.edu
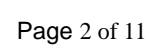
(Week 6-10: Oct.01-Oct.28)

0. Pre-Illumination

For clearly describing the relational schema design, we separate this report into four sections. In Section 1 we modify the original EER diagram and explain what are changed, respect to our Phase I EER diagram. And then, in Section 2 we give the relational schemas converted from our Phase I EER diagram with detailed mapping step by step. Section 3 is the documentation of relational schemas. This documentation mainly describes data type and format for each attribute in each relational schema. We also explain our assumptions for the documentation in this section. Finally, a short summary is given at the end of this report.

1. Modified EER diagram

(Check ER Diagram on next page)

Held_time

Name
Events
City

holder
M
holds
organizes

Desc
Event_holders
id

attends and evaluates
Name

date   time
schedules
1
Hospital
N
Evaluation_score
U

doctor_name
N
1

Treatment_type
appointment
has
stores
1

Receptionist_info
d
Call   Online

M

Line1   Line2
Zip_code
Address
SSN   ID   Salary
Quantity
medicines
Type
Storedin_dt

City
Name
Employee
Gender
ID
Name   Price
manages

State
Join_dt   Dept_Name
E-mail
Degree

Age   Title
Phone
invite_srno
Attendees
Pharmacist

speciality
Doctor-na   id   Availability
Volunteer

lang   m_school
lang
Nurse
Nurse-na
Disp_info
Dispense_dt

Doctor
Visits
Date_time
IS_A
dispense_medicine

Level
Manager
Receptionist
Support_staff

1
prescribes
no_hrs
d
has

result
N
M
arranges
N
Part_time   Full_time
N

treats
N
Start_time   Lic#

fees
gives_appntmnt
Name
Carries
1
Driver

C_Name   Policy#
N
Relatives
M
End_time

Phone   Insurance
have
Patient_id

Expired_date
Lang   F_name   L_name   Reason

M
ID
Driver

have
History
works_at

1
Patient
N

Gen
N
N

City   Zip
Address   DOB
Services

Line1
State
1

Line2
E_mail

M
SSN   O
Stored_date

Manages/works_at
In_patient   Out_patient
Receives
Ambulance
Lic#

1
ID
Location

Department
End_time   St_time
IS_Assigned

Location
1
Pharmacy

Accnt_no.
Phone_number
Room#   ID
Bed

Accnt_holder
Name
Bill
status   Ambulance

Billed_patient
Bed
Prescription

Bank_name   Billing_Addr   Expired_Date
Treatment

The modification does not mean that the original design is incorrect. Actually, our original design is more close to real life. But when we implement, we want to make the process easier. Besides, the new way will not affect the functionality of this database. The modified EER diagram is shown in Figure 1.
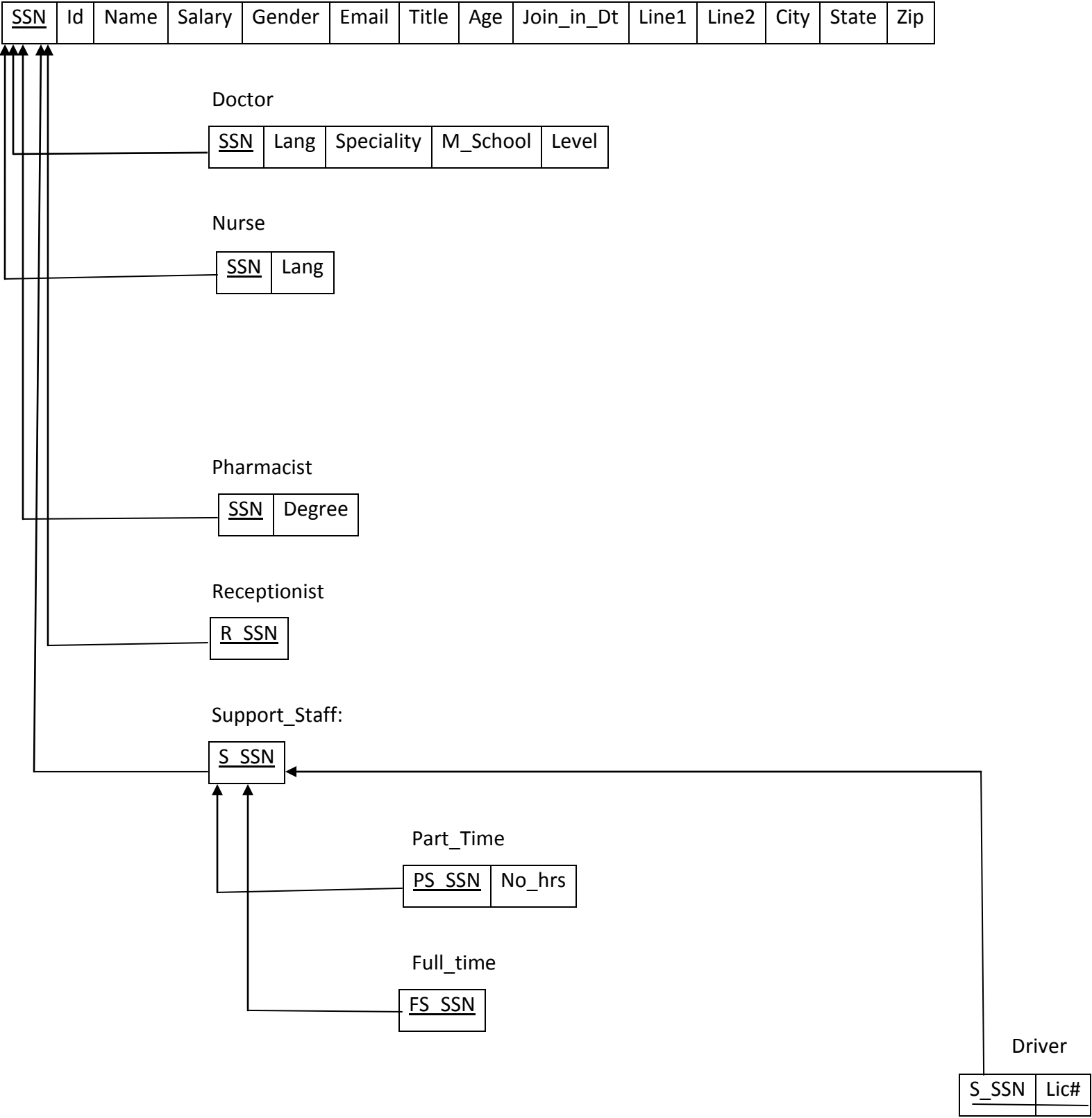
2. Mapping Relational Schemas

We use seven-step algorithm to convert the basic EER model constructs into relations. The following are detailed mapping process.

2.1 Mapping of Regular Entity Types, Specializations.

Since the relationships in this database are all relate to the sub-class of School Personnel, we map specializations together with regular entity types.

8A.Employee:

SSN	Id	Name	Salary	Gender	Email	Title	Age	Join_in_Dt	Line1	Line2	City	State	Zip

Doctor

SSN	Lang	Speciality	M_School	Level

Nurse

SSN	Lang

Pharmacist

SSN	Degree

Receptionist

R_SSN

Support_Staff:

S_SSN

Part_Time

PS_SSN	No_hrs

Full_time

FS_SSN

Driver

S_SSN	Lic#

Department

ID	Name	Location	Phone_No	Mgr_SSN

Patient

ID	FName	LName	Reason	Driver	Email	DOB	Line1	Line2	City	State	Zip	Gender	History

8D

In_Patient

ID	SSN

Out_patient

ID

8A

Billed_Patient

Patient_Id	Acc_no	Acc_holder	BankName	Billing_addr	Exp_date

Events

Name	Held_Time	Description

8C.Event_holders

Name	E_SSN

Name	V_Id

Volunteer

V_id	Age	Availability

8D.Attendees

Invite_sr_no	PID	Relative_Name	E_Score

Appointment

Date	Time	PID

Medicines

M_ID	Name	Price	Stored_in_dt	Type	Qty

Insurance

Cpmpany_Name	Policy#	PID	Phone	Exp_dt

Ambulance

Lic#	Stored_dt	Location

8B

 Call

Date	Time	PID	Treatment_type	Doc_name	Receptionist_info

Online

Date	Time	PID	Treatment_type	Doc_Name

2.2 Mapping of Weak Entity Types

Relatives

P_ID	Rel_Name
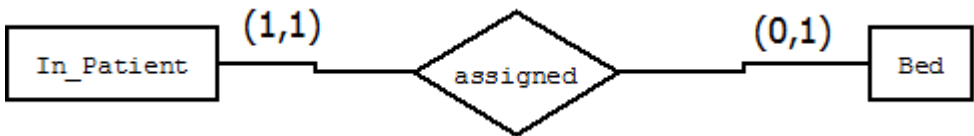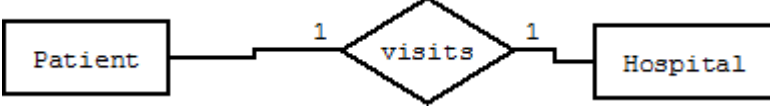
Bill

B_No	P_ID	Status	Bed	Prescription	Ambulance	Pharmacy

2.3 Mapping of Binary 1:1 Relationship Types
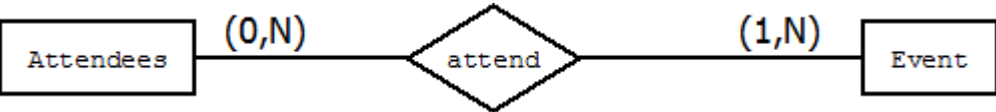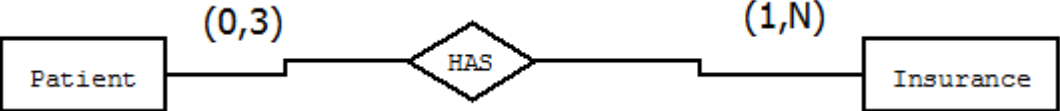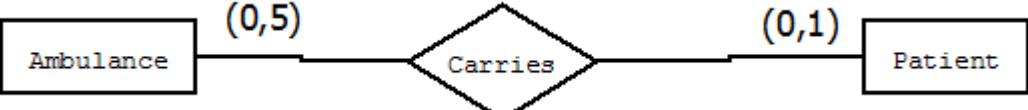
The mapping method is exhibited in Table 1.

Table 1. Mapping Method to Binary 1:1 Relationship
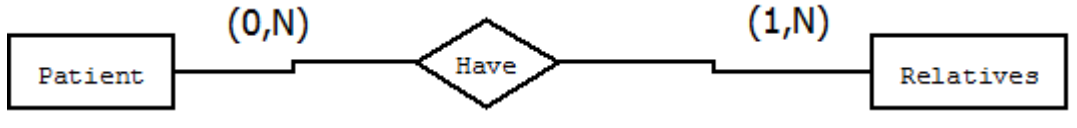
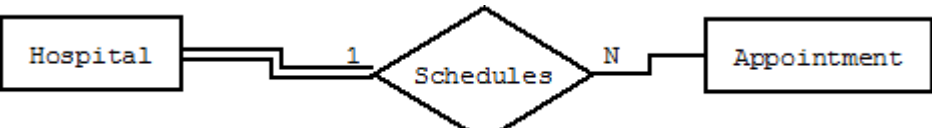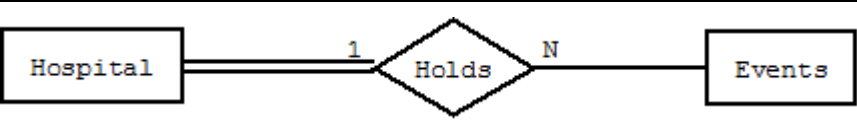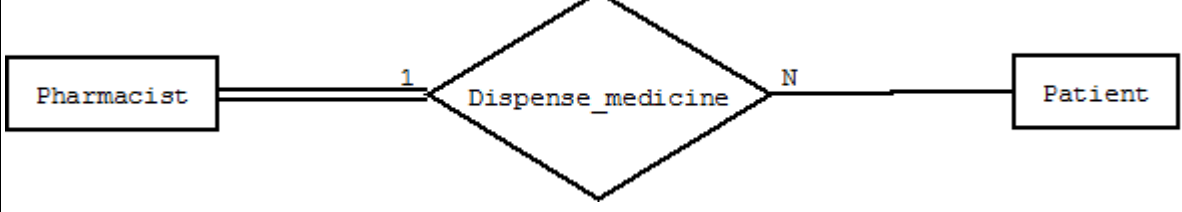| Relation	Mapping Method
In_Patient (1,1) assigned (0,1) Bed	To map this relationship we use relationship like each in_patient is assigned one bed with unique id that is primary key of entity bed.
Patient (1,1) receives (1,1) Bill	To map this relationship, we have used foreign key approach. The ID of patient refers to P_ID in bill entity.
Patient 1 visits 1 Hospital	Here to map this relationship, we have shown that each patient visits hospital where participation of hospital is total.

2.4 Mapping of Binary 1:N Relationship Types

The mapping method is exhibited in Table 2.

Table 2. Mapping Method to Binary 1:N Relationship

Relation	Mapping Method
Attendees (0,N) attend (1,N) Event	The n-side of relationship is attendees. Here E_Name of attendees refers to name of entity Events. Thus name attribute of event entity is foreign key for attendees entity.
Patient (0,3) HAS (1,N) Insurance	To map this relationship, we have used foreign key approach. Here policy number of insurance refers to Ins_policy of patient entity.i.e Ins_Policy is foreign key for insurance entity.
Ambulance (0,5) Carries (0,1) Patient	To map this relationship, we have used foreign key approach. Here A_LIC# of patient refers to LIC# of ambulance .i.e A_Lic# is foreign key for ambulance entity.

Manager (1,1) —◇ manages ◇— (1,N) Department	Here mapping in this relationship is through foreign key approach. We mapped this relationship by department id which indicates the id of department where manager works.
Patient (0,N) —◇ Have ◇— (1,N) Relatives	Here relatives are at N side of relationship. We have used foreign key approach to map this relationship. Here P_ID works as foreign key for relatives entity.
Doctor (0,N) —◇ prescribes ◇— (1,N) Patient	Here patient is at N-side of relationship. D_SSN of patient entity refers to D_SSN of doctor entity. D_SSN of patient entity refers to doctor that treats that patient.
Hospital 1 —◇ Schedules ◇— N Appointment	Here Appointment is at N-side of relationship. It describes that one hospital schedules multiple appointment.
Hospital 1 —◇ Holds ◇— N Events	Here Events is at N-side of relationship. It describes that one hospital holds multiple events.
Pharmacist 1 —◇ Dispense_medicine ◇— N Patient	Here Patient is at N-side of relationship.Here one pharmacist dispenses medicine to multiple patients. We have used foreign key approach to map this relationship.

2.5 Mapping of Binary M:N Relationship Types

Works_at

D_LIC#	A_LIC#

Treats

DSSN	Patient_Id	Result	Fees

2.6 Mapping of Multi-valued Attributes

Event_City

Event_Name	E_City

E_DepName

ESSN	Dept_Name

Doc_Speciality

DSSN	Speciality

Doc_Lang

DSSN	DLang

Patient_Phno

PID	Phn_no

Nurse_Lang

Nurse_SSN	N_Lang

2.7 Mapping of N-ary Relationship Types

Arrange_Work

DSSN	RSSN	Nurse_SSN

2.8 Final Relation Schema of Hospital Database

After seven steps mapping, we can get the final result of relation schema. Besides, we point out foreign keys by arrows from foreign key to the original keys between two relations.

Figure 5 displays all the relational schemas converted from Phase I EER diagram.

Put your Relational model here.

8A.Employee:

SSN	Id	Name	Salary	Gender	Email	Title	Age	Join_in_Dt	Line1	Line2	City	State	Zip	Dept_id

Doctor

SSN	Lang	Speciality	M_School	Level

Nurse

SSN	Lang

Nurse_Lang

Nurse_SSN	N_Lang

Manager

MGR_SSN

Pharmacist

SSN	Degree

Treats

DSSN	Patient_Id	Result	Fees

Receptionist

R_SSN

Arrange_Work

DSSN	RSSN	Nurse_SSN

Support_Staff:

S_SSN

Part_Time

PS_SSN	No_hrs

Full_time

FS_SSN

Driver

S_SSN	Lic#

Department

ID	Name	Location	Phone_No

Patient

ID	FName	LName	Reason	Driver	Email	DOB	Line1	Line2	City	State	Zip	Gender	History	D_SSN	Ins_policy	A_Lic#

8D

Patient_typ

ID	FName	LName	Reason	Driver	Email	DOB	Line1	Line2	City	State	Zip	Gender	History	InFlag	SSN	O_Flag

8A

Billed_Patient

Patient_Id	Acc_no	Acc_holder	BankName	Billing_addr	Exp_date

Events

Name	Holder	Held_Time	Description

8C.Event_holders

Holder_id	Holder_Na	EFlag	SSN	ID	Name	Salary	Gender	Email	Title	Age	Join_dt	Line1	Line2	City	State	Zip	VFlag	Id	Age	Availability

8D.Attendees

Invite_sr_no	PFlag	PID	FName	LName	Reason	Driver	Email	DOB	Line1	Line2	City	State	Zip	Gender	History	RFlag	Relative_Name	E_Name

Appointment
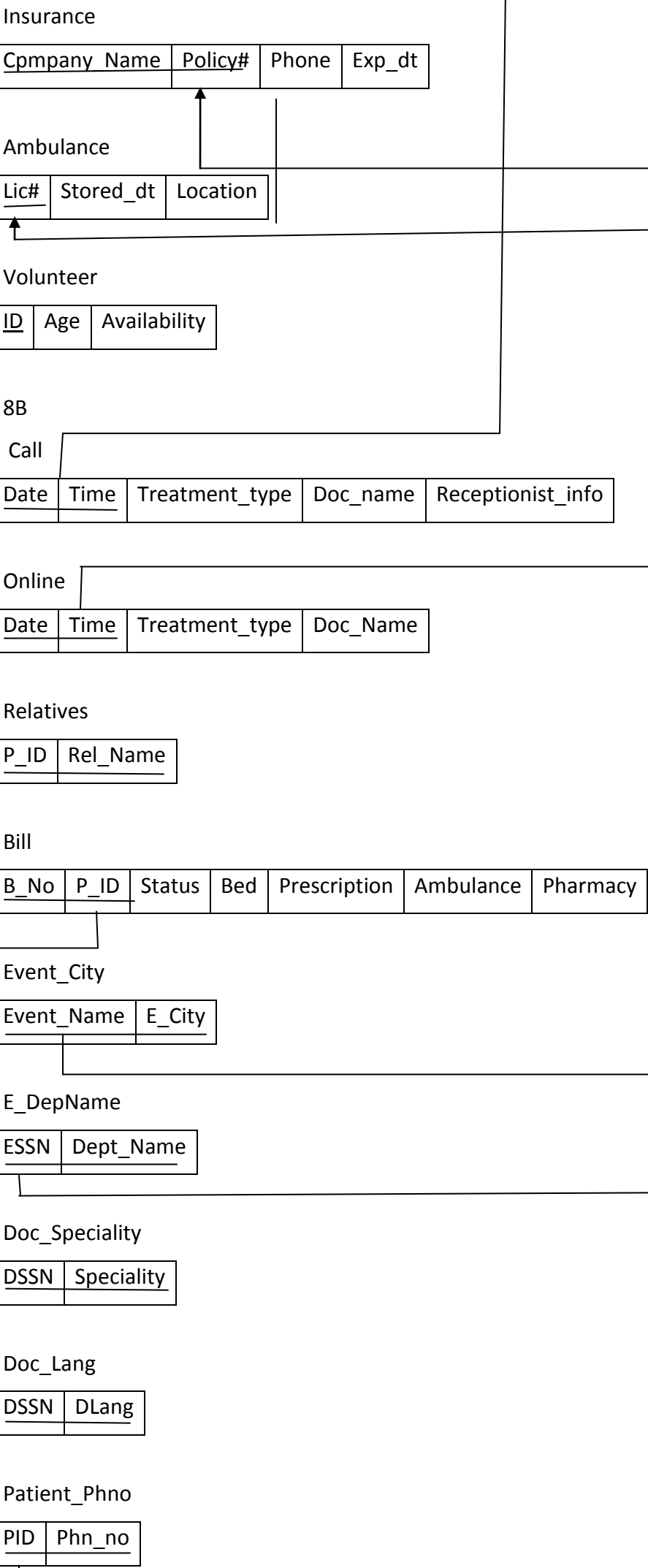
Date	Time	Doc_Name	Treat_type

Medicines

ID	Name	Price	Stored_in_dt	Type	Qty

Works_at

D_LIC#	A_LIC#

Insurance

Cpmpany_Name	Policy#	Phone	Exp_dt

Ambulance

Lic#	Stored_dt	Location

Volunteer

ID	Age	Availability

8B

Call

Date	Time	Treatment_type	Doc_name	Receptionist_info

Online

Date	Time	Treatment_type	Doc_Name

Relatives

P_ID	Rel_Name

Bill

B_No	P_ID	Status	Bed	Prescription	Ambulance	Pharmacy

Event_City

Event_Name	E_City

E_DepName

ESSN	Dept_Name

Doc_Speciality

DSSN	Speciality

Doc_Lang

DSSN	DLang

Patient_Phno

PID	Phn_no

3. Documentation for schemas

3.1 Explanation for format design

After mapping the EER diagram into relation schema that can be implemented in a relational DBMS like Oracle, we should also design the format of each attribute in every relation. Here we suppose that all the assumptions, explanations and limitations in phase I are also suitable for the design in this phase. Thus, we shall not repeat them. In this section, we only explain our assumptions for the data types and formats in the documentation. The rules are shown as follows:

-Data format for all IDs is XXX-XX-XXXX.

-All IDs shall have exactly 11 characters.

-Email must match xxx@xxx.com format.

-SSN is of format: xxx-xx-xxxx with integer size 9

3.2 Format for Every Relation

Table 3 gives data type and format for each attribute in each relational schema.

Table 3. Format for Each Attribute

Relation Names	Attributes	Date Type
Employee	E_SSN	xxx-xx-xxxx Integer=9
	ID	String <= 11 chars
	Name	String <= 20 chars
	Salary	Long integer
	Gender	String
	Email	String<=20 chars
	Title	String
	Age	Integer<=100
	Join_in_Date	Date
	Line1	String<=20 chars
	Line2	string <= 20 chars
	Zip	String <= 10 chars
	City	String<=20 chars
	State	String<=20 chars

Relation Names	Attributes	Data Type
Department	ID	String<=11 chars
	Name	String<=20 chars
	Location	String<=20 chars
	Phone_no	xxx-xxx-xxxx integer=10 chars

Relation Names	Attributes	Data Type
Patient	ID	String<=11 chars
	FName	String<=20 chars
	LName	String<=20 chars
	Phone_no	xxx-xxx-xxxx integer=10 chars
	Reason	String<=30 chars
	Driver	String<=20 chars
	Email	String<=20 chars
	DOB	Date
	Line1	String<=20 chars
	Line2	String<=20 chars
	City	String<=20 chars
	State	String<=20 chars
	Zip	String<=10 chars
	Gender	String
	History	String<=25 chars
	Ins_Policy	String<=10 chars
	D_SSN	xxx-xx-xxxx Integer=9
	A_LIC#	Integer<=10

Relation Names	Attributes	Data Type
Events	Name	String<=20 chars
	Holder	String<=20 chars
	Held_time	Date
	Description	String<=30 chars

Relation Names	Attributes	Data Type
Appointment	Date	Date
	Time	Date
	Doc_Name	String<=20 chars
	Treat_type	String<=20 chars

Relation Names	Attributes	Data Type
Medicine	ID	Integer<=10
	Name	String<=20 chars
	Price	Integer
	Stored_in_Date	Date
	Type	String<=20 chars
	Qty	Integer

Relation Names	Attributes	Data Type
Insurance	Comp_Name	String<=20 chars
	Policy#	Integer<=10
	Phone#	xxx-xxx-xxxx integer=10 chars
	Exp_Date	Date

Relation Names	Attributes	Data Type
Ambulance	Lic#	Integer<=10
	Stored_Date	Date

	Location	String<=20 chars

Relation Names	Attributes	Data Type
Volunteer	ID	String<=11 chars
	Age	Integer
	Availability	Boolean

Relation Names	Attributes	Data Type
Relatives	P_ID	Integer<=10
	Rel_Name	String<=20 chars

Relation Names	Attributes	Data Type
Bill	Bill#	Long Integer<=10
	P_SSN	xxx-xx-xxxx String=9 chars
	Bed	Long Integer<=10
	Status	Boolean
	Prescription	String<=30 chars
	Ambulance	Long Integer<=10
	Pharmacy	Long Integer<=10

Relation Names	Attributes	Data Type
Doctor	D_SSN	xxx-xx-xxxx Integer=9
	Lang	String<=10 chars
	M_School	String<=20 chars
	Level	String<=10 chars

Relation Names	Attributes	Data Type
Nurse	N_SSN	xxx-xx-xxxx Integer=9
	Lang	String<=10 chars

Relation Names	Attributes	Date Type
Manager	Mgr_SSN	XXX-XX-XXXX, String = 9 chars
	ID	String <= 11 chars
	Name	String <= 20 chars

Relation Names	Attributes	Date Type
Pharmacist	PH_SSN	XXX-XX-XXXX, String = 9 chars
	ID	String <= 11 chars
	Name	String <= 20 chars

Relation Names	Attributes	Date Type
Receptionist	R_SSN	XXX-XX-XXXX, String = 9 chars
	ID	String <= 11 chars
	Name	String <= 20 chars

Relation Names	Attributes	Date Type
Support Staff	SS_SSN	XXX-XX-XXXX, String = 9 chars
	ID	String <= 11 chars
	Name	String <= 20 chars

Relation Names	Attributes	Date Type
Part-Time	PS_SSN	XXX-XX-XXXX, String = 9 chars

	ID	String <= 11 chars
	Name	String <= 20 chars

Relation Names	Attributes	Date Type
Full-TIme	FS_SSN	XXX-XX-XXXX, String = 9 chars
	ID	String <= 11 chars
	Name	String <= 20 chars

Relation Names	Attributes	Data Type
In_Patient	ID	String<=11 chars
	FName	String<=20 chars
	LName	String<=20 chars
	IP_SSN	xxx-xx-xxxx Integer=9

Relation Names	Attributes	Data Type
Out_Patient	ID	String<=11 chars
	FName	String<=20 chars
	LName	String<=20 chars

Relation Names	Attributes	Data Type
Call	Date	Date
	Time	Date
	Treatment_Type	String<=20 chars
	Doc_Name	String<=20 chars
	Receptionist_info	String<=20 chars

Relation Names	Attributes	Data Type
Online	Date	Date
	Time	Date
	Treatment_Type	String<=20 chars
	Doc_Name	String<=20 chars

Relation Names	Attributes	Data Type
Event Holders	ESSN	xxx-xx-xxxx Integer=9
	Vol_ID	String

Relation Names	Attributes	Data Type
Attendees	ID	String<=11 chars
	FName	String<=20 chars
	LName	String<=20 chars
	Relative_Name	String<=20 chars

Relation Names	Attributes	Data Type
Billed Patient	Patient_ID	String
	Acc#	Long Integer<=10
	Acc_Holder	String<=20 chars
	Bank_Name	String<=20 chars
	Billing_Addr	String<=30 chars
	Exp_Date	Date

Relation Names	Attributes	Data Type
Treats	DSSN	xxx-xx-xxxx Integer=9

	Patient_Id	string<=11 chars
	Result	String<=50 chars
	Fees	String<=20 chars

Relation Names	Attributes	Data Type
Arrange_work	DSSN	xxx-xx-xxxx Integer=9
	RSSN	string<=11 chars
	Nurse_SSN	String<=50 chars

Relation Names	Attributes	Data Type
Works_At	D_LIC#	String<10chars
	A_LIC#	string<=10 chars

Relation Names	Attributes	Data Type
Driver	S_SSN	xxx-xx-xxxx Integer=9
	LIC#	string<=10 chars

4. Conclusion

In this report we discussed and drew the relational schemas for Database of XXX. We also give the data type and format for each attribute in each schema. Then we explain our assumptions in the documentation. This report analyzed the logical model of Database. The next step is to implement this database. In the future, we may change some design when facing practical difficulties and other requests.