



**Department of Computer Science and Engineering
University of Dhaka**

**CSE – 2201
Database Management Systems-I**

Project : Hospital Database Management System

Submitted to:

Mr. Abu Ahmed Ferdaus
Associate Professor
Department of Computer Science and Engineering
University of Dhaka.

Submitted by:

Kazi Shadman Sakib
Roll : FH - 097
Registration Number : 2017-614-973
2nd Year, CSEDU.

Introduction

Hospitals are the institution providing medical and surgical treatment and nursing care for any ill or injured people.

It is an integral part of social and medical organization. The function of Hospital is to provide complete health care to the needy one, both curative and preventive. It is also a center for providing training to health workers and center for bio-social research.

Project Description

The database which I have created contains information of Hospital, Branch name, Departments, Doctors, Patients, Operation, Bill and Treatment. This information can be used to keep track of number of Branches of a Hospital, number of Departments in a Hospital, which Doctor works for which Hospital's Branch, which Patient gets treatment from which Hospital's Branch and Department, Bills of Patients which is charged by a certain Hospital, where a Patient have Operation the most, Doctor's specialties ect.

Design Phases :

Initial Phase : Characterizing fully the data needs of the prospective database users. In this case, Hospital.

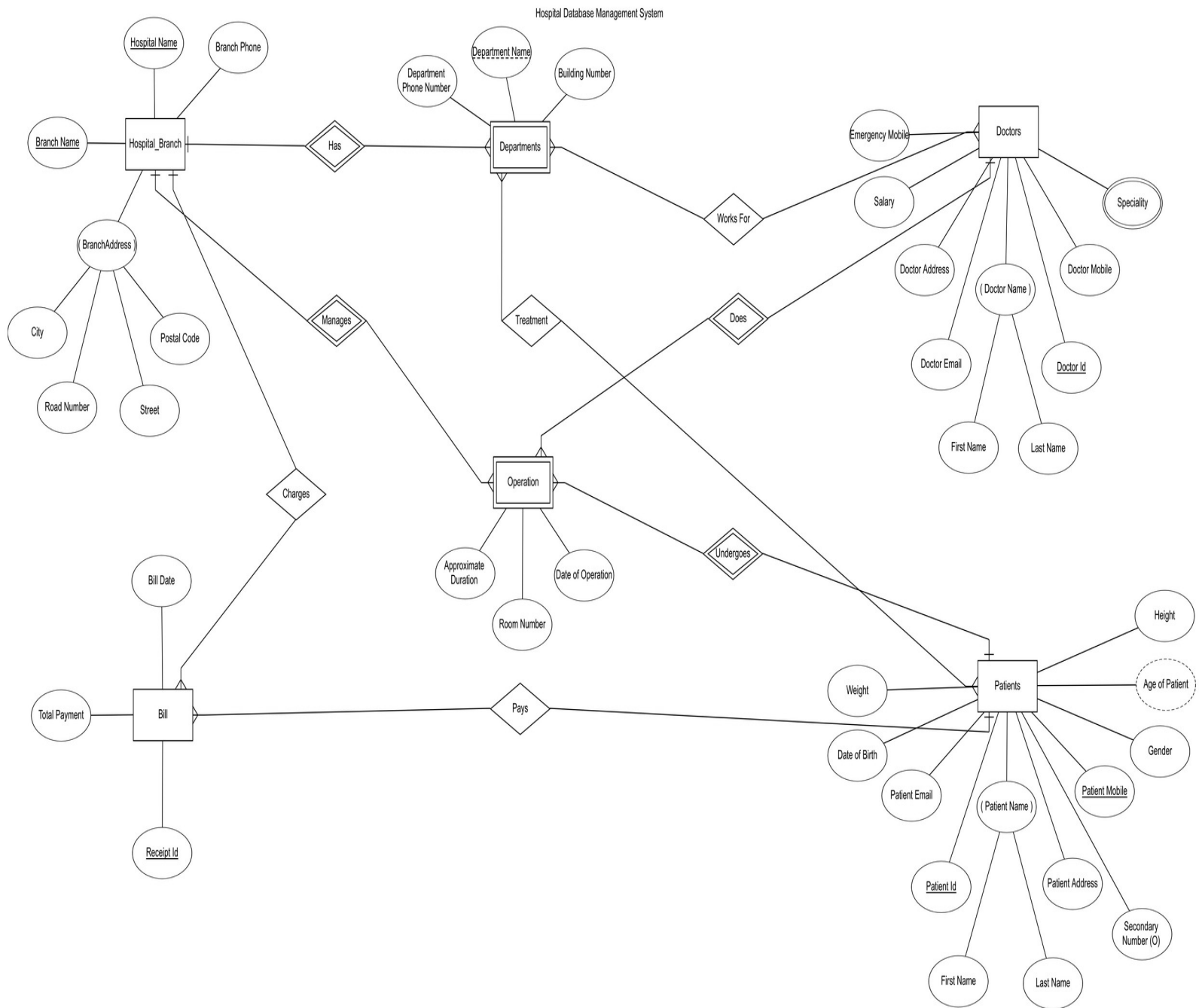
Second Phase : An ER Diagram is created which resembles the actual Hospital. This diagram indicates the functional requirements of the Hospital enterprise.

Final Phase : Then moving from an abstract data model to implementation of the database. Here the Entity Relationship Model (ER Diagram) is converted into an Relational Model and corresponding tables are created.

Some queries are also shown at last as an example on how to analyze the data.

P.S – The tables were populated with randomly generated data.

Entity Relationship Model (ER Diagram)



Schema of the Database with Attributes

Hospital_Branch(Hospital Name, Branch Name, City, Road Number, Street, Postal Code, Branch Phone)

Departments(Department Name, Hospital Name, Branch Name, Building Number, Department Phone Number)

Doctors(Doctor Id, First Name, Last Name, Doctor Mobile, Doctor Email, Doctor Address, Salary, Emergency Mobile)

Doctors Speciality(Speciality, Doctor Id)

Patients(Patient Id, Patient Mobile, First Name, Last Name, Date of Birth, Weight, Gender, Patient Address, Patient Email, Height, Secondary Number)

Works For(Doctor Id, Department Name, Hospital Name, Branch Name)

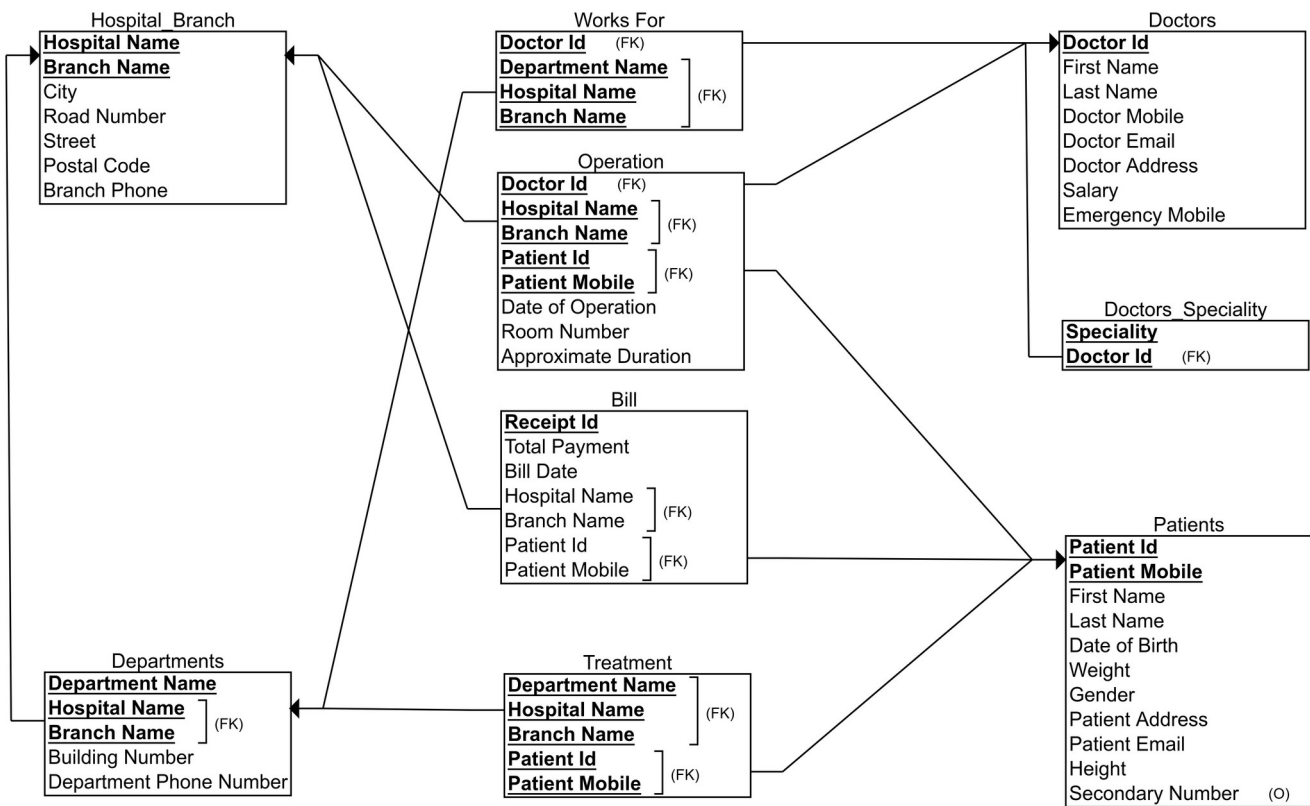
Operation(Doctor Id, Hospital Name, Branch Name, Patient Id, Patient Mobile, Date of Operation, Room Number, Approximate Duration)

Bill(Receipt Id, Total Payment, Bill Date, Hospital Name, Branch Name, Patient Id, Patient Mobile)

Treatment(Department Name, Hospital Name, Branch Name, Patient Id, Patient Mobile)

Schema Diagram of the Database

Hospital Database Management System



Snapshots of SQL DDL of all the Schema/Tables

```
CREATE TABLE Hospital_Branch
(
    Hospital_Name VARCHAR(100) NOT NULL,
    Branch_Name VARCHAR(50) NOT NULL,
    City VARCHAR(50) NOT NULL,
    Road_Number VARCHAR(50) NOT NULL,
    Street VARCHAR(50) NOT NULL,
    Postal_Code INT NOT NULL,
    Branch_Phone VARCHAR(50) NOT NULL,
    PRIMARY KEY (Hospital_Name, Branch_Name)
);
```

```
CREATE TABLE Doctors
(
    Doctor_Id VARCHAR(50) NOT NULL,
    First_Name VARCHAR(50) NOT NULL,
    Last_Name VARCHAR(50) NOT NULL,
    Doctor_Mobile VARCHAR(50) NOT NULL,
    Doctor_Email VARCHAR(50) NOT NULL,
    Doctor_Address VARCHAR(50) NOT NULL,
    Salary INT NOT NULL,
    Emergency_Mobile VARCHAR(50) NOT NULL,
    PRIMARY KEY (Doctor_Id)
);
```

```
CREATE TABLE Departments
(
    Department_Name VARCHAR(100) NOT NULL,
    Hospital_Name VARCHAR(100) NOT NULL,
    Branch_Name VARCHAR(50) NOT NULL,
    Building_Number INT NOT NULL,
    Department_Phone_Number VARCHAR(50) NOT NULL,
    PRIMARY KEY (Department_Name, Hospital_Name, Branch_Name),
    FOREIGN KEY (Hospital_Name, Branch_Name) REFERENCES Hospital_Branch(Hospital_Name, Branch_Name)
);
```

```
CREATE TABLE Patients
(
    Patient_Id INT NOT NULL,
    Patient_Mobile VARCHAR(50) NOT NULL,
    First_Name VARCHAR(50) NOT NULL,
    Last_Name VARCHAR(50) NOT NULL,
    Date_of_Birth VARCHAR(50) NOT NULL,
    Weight INT NOT NULL,
    Gender VARCHAR(50) NOT NULL,
    Patient_Address VARCHAR(50) NOT NULL,
    Patient_Email VARCHAR(50) NOT NULL,
    Height VARCHAR(50) NOT NULL,
    Secondary_Number VARCHAR(50),
    PRIMARY KEY (Patient_Id, Patient_Mobile)
);
```

```
CREATE TABLE Doctors_Speciality
(
    Speciality VARCHAR(50) NOT NULL,
    Doctor_Id VARCHAR(50) NOT NULL,
    PRIMARY KEY (Speciality, Doctor_Id),
    FOREIGN KEY (Doctor_Id) REFERENCES Doctors(Doctor_Id)
);
```

```

CREATE TABLE Bill
(
    Receipt_Id INT NOT NULL,
    Total_Payment INT NOT NULL,
    Bill_Date VARCHAR(50) NOT NULL,
    Hospital_Name VARCHAR(100) NOT NULL,
    Branch_Name VARCHAR(50) NOT NULL,
    Patient_Id INT NOT NULL,
    Patient_Mobile VARCHAR(50) NOT NULL,
    PRIMARY KEY (Receipt_Id),
    FOREIGN KEY (Hospital_Name, Branch_Name) REFERENCES Hospital_Branch(Hospital_Name, Branch_Name),
    FOREIGN KEY (Patient_Id, Patient_Mobile) REFERENCES Patients(Patient_Id, Patient_Mobile)
);

```

```

CREATE TABLE Treatment
(
    Department_Name VARCHAR(100) NOT NULL,
    Hospital_Name VARCHAR(100) NOT NULL,
    Branch_Name VARCHAR(50) NOT NULL,
    Patient_Id INT NOT NULL,
    Patient_Mobile VARCHAR(50) NOT NULL,
    PRIMARY KEY (Department_Name, Hospital_Name, Branch_Name, Patient_Id, Patient_Mobile),
    FOREIGN KEY (Department_Name, Hospital_Name, Branch_Name) REFERENCES Departments(Department_Name, Hospital_Name, Branch_Name),
    FOREIGN KEY (Patient_Id, Patient_Mobile) REFERENCES Patients(Patient_Id, Patient_Mobile)
);

```

```

CREATE TABLE Operation
(
    Doctor_Id VARCHAR(50) NOT NULL,
    Hospital_Name VARCHAR(100) NOT NULL,
    Branch_Name VARCHAR(50) NOT NULL,
    Patient_Id INT NOT NULL,
    Patient_Mobile VARCHAR(50) NOT NULL,
    Date_of_Operation VARCHAR(50) NOT NULL,
    Room_Number INT NOT NULL,
    Approximate_Duration VARCHAR(50) NOT NULL,
    PRIMARY KEY (Doctor_Id, Hospital_Name, Branch_Name, Patient_Id, Patient_Mobile),
    FOREIGN KEY (Doctor_Id) REFERENCES Doctors(Doctor_Id),
    FOREIGN KEY (Hospital_Name, Branch_Name) REFERENCES Hospital_Branch(Hospital_Name, Branch_Name),
    FOREIGN KEY (Patient_Id, Patient_Mobile) REFERENCES Patients(Patient_Id, Patient_Mobile)
);

```

```

CREATE TABLE Works_For
(
    Doctor_Id VARCHAR(50) NOT NULL,
    Department_Name VARCHAR(100) NOT NULL,
    Hospital_Name VARCHAR(100) NOT NULL,
    Branch_Name VARCHAR(50) NOT NULL,
    PRIMARY KEY (Doctor_Id, Department_Name, Hospital_Name, Branch_Name),
    FOREIGN KEY (Doctor_Id) REFERENCES Doctors(Doctor_Id),
    FOREIGN KEY (Department_Name, Hospital_Name, Branch_Name) REFERENCES Departments(Department_Name, Hospital_Name, Branch_Name)
);

```

Snapshots of the Instances (Data of the Populated Tables)

Hospital_Branch :

	🏥 hospital_name	🏥 branch_name	📍 city	📍 road_number	📍 street	📍 postal_code	📞 branch_phone
1	Anwer Khan Modern Hospital Ltd.	Dhanmondi	Dhaka	8	19	1205	02-9670295
2	Apollo Hospital	Basundhara	Dhaka	Block E	09	1229	09666-710678
3	Care Hospital Ltd.	Mohammadpur	Dhaka	2/1-A Iqbal	01	1207	9132548
4	City Hospital Ltd.	Mohammadpur	Dhaka	Satmosjid Road	Lalmatia Housing Street	1207	02-8143312
5	Delta Medical Center Ltd	Dhanmondi	Dhaka	4	04	1205	01929-713057
6	Dhaka Community Hospital	Ramna	Dhaka	Baro Moghbazar	Wireless Railgate	1217	02-9351190
7	Dhaka Medical College Hospital	Puran Dhaka	Dhaka	13A	Dhaka University Street	1000	02-55165088
8	Green Eye & General Hospital	Dhanmondi	Dhaka	06	18	1205	01778-408060
9	Greenland Hospital	Uttara	Dhaka	04	07	1230	01716-623627
10	Holy Family Red Crescent Medical College and Hospital	MoghBazar	Dhaka	1 Eskaton Garden Road	13	1217	02-49353031
11	Ibn Sina Hospital	Dhanmondi	Dhaka	15/A	25	1209	02-47118925
12	Ibrahim Cardiac Hospital and Research Institute	Puran Dhaka	Dhaka	Kazi Nazrul Islam Avenue	Shahbagh	1000	01714-006706
13	Labaid Specialized Hospital	Puran Dhaka	Dhaka	16	05	1000	09666-710606
14	Labaid Specialized Hospital	Uttara	Dhaka	03	06	1230	01766-662606
15	Labaid Specialized Hospital	Gulshan	Dhaka	18	26	1212	09666-710606
16	Mirpur Adhunik Hospital	Mirpur	Dhaka	05	12 Dha	1216	01550019746
17	Mirpur General Hospital	Mirpur	Dhaka	01	10	1216	01785-906599
18	Popular Diagnostic Center Ltd.	Uttara	Dhaka	04	06	1230	09613-787805
19	Popular Diagnostic Center Ltd.	Dhanmondi	Dhaka	17	42	1205	09613-787807
20	SQUARE Hospitals Ltd.	Mirpur	Dhaka	Mirpur Road	Chorai Bazar	1216	01713-141447

Departments :

	🏥 department_name	🏥 hospital_name	🏥 branch_name	📍 building_number	📞 department_phone_number
1	Anesthesiology	Anwer Khan Modern Hospital Ltd.	Dhanmondi	2	7734365541
2	Cardiology	Anwer Khan Modern Hospital Ltd.	Dhanmondi	1	8811293977
3	Endocrinology	Anwer Khan Modern Hospital Ltd.	Dhanmondi	1	2101793414
4	Gastroenterology	Anwer Khan Modern Hospital Ltd.	Dhanmondi	1	6826870736
5	Gynecology	Anwer Khan Modern Hospital Ltd.	Dhanmondi	4	9183572149
6	Nephrology	Anwer Khan Modern Hospital Ltd.	Dhanmondi	2	4908302930
7	Obstetrician	Anwer Khan Modern Hospital Ltd.	Dhanmondi	4	4903526353
8	Oncology	Anwer Khan Modern Hospital Ltd.	Dhanmondi	1	1079429238
9	Ophthalmology	Anwer Khan Modern Hospital Ltd.	Dhanmondi	4	3569142760
10	Otolaryngology	Anwer Khan Modern Hospital Ltd.	Dhanmondi	4	9771777486
11	Psychiatry	Anwer Khan Modern Hospital Ltd.	Dhanmondi	1	4268837607
12	Pulmonology	Anwer Khan Modern Hospital Ltd.	Dhanmondi	1	1048921373
13	Radiology	Anwer Khan Modern Hospital Ltd.	Dhanmondi	4	5209653599
14	Rheumatology	Anwer Khan Modern Hospital Ltd.	Dhanmondi	1	1045217378
15	Surgery	Anwer Khan Modern Hospital Ltd.	Dhanmondi	3	9776777039
16	Urology	Anwer Khan Modern Hospital Ltd.	Dhanmondi	4	7578070309
17	Anesthesiology	Apollo Hospital	Basundhara	3	3589440695
18	Cardiology	Apollo Hospital	Basundhara	2	7547316230
19	Endocrinology	Apollo Hospital	Basundhara	2	7438494715
20	Gastroenterology	Apollo Hospital	Basundhara	3	9523189031
21	Gynecology	Apollo Hospital	Basundhara	1	8929879000
22	Nephrology	Apollo Hospital	Basundhara	2	7579105681
23	Obstetrician	Apollo Hospital	Basundhara	4	9886180609
24	Oncology	Apollo Hospital	Basundhara	4	5368628176

Doctors :

	👤 doctor_id	👤 first_name	👤 last_name	📞 doctor_mobile	✉️ doctor_email	🏠 doctor_address	💰 salary	📞 emergency_mob
1	860414	Tahmid	Mosaddek	01587628266	Mosaddek9560@gmail.com	672/4 Tejgaon, House No: 133, Dhaka-1213	85000	01754488767
2	798204	Nashmin	Nawar	01727467323	Nawar815@yahoo.com	610/5 Gulshan, House No: 233, Dhaka-1240	79000	01576225975
3	372273	Mohammad Foyсал	Khan	01933235096	Khan82@gmail.com	418/1 Rampura, House No: 775, Dhaka-1074	55000	01571808586
4	920950	Abdul Mohaimen	Al	01755098098	A2870@yahoo.com	519/9 Gulshan, House No: 518, Dhaka-1210	107000	01979052519
5	638656	Prothito Shovon	Majumder	01529662119	Majumder7034@gmail.com	818/3 Uttara, House No: 542, Dhaka-1296	112000	01973018397
6	970811	Umaar Abdullah	Morshed	01528361727	Morshed5397@yahoo.com	857/2 Mogbazar, House No: 307, Dhaka-1150	108000	01795333836
7	476157	Jawad	Habib	01921435198	Habib5580@gmail.com	597/10 Dhanmondi, House No: 459, Dhaka-1264	85000	01794411925
8	328285	Md. Mainul Islam	Fahim	01536342296	Fahim5025@yahoo.com	453/10 Uttara, House No: 818, Dhaka-1087	109000	01715230863
9	703141	Shamuel Chowdhury	Siam	01946067424	Siam293@gmail.com	563/7 Uttara, House No: 408, Dhaka-1080	126000	01578555490
10	507918	Mohidul Haque	Mridul	01971408620	Mridul4600@gmail.com	886/8 Banani, House No: 161, Dhaka-1267	118000	01549029449
11	137214	Alif	Ruslan	01587459828	Ruslan2980@gmail.com	409/7 Khilgaon, House No: 862, Dhaka-1146	118000	01795167988
12	964401	Imran	Zahid	01981354384	Zahid5833@yahoo.com	741/10 Siddeshwari, House No: 264, Dhaka-1227	83000	01783603891
13	440171	Farhan	Mahmud	01718968469	Mahmud1492@yahoo.com	291/6 Dhanmondi, House No: 561, Dhaka-1051	79000	01943230222
14	854018	Farwaz Mohammed	Amin	01958725217	Amin3959@gmail.com	238/10 Uttara, House No: 241, Dhaka-1223	61000	01954177311
15	542443	Abdullah Ibne	Masud	01717520945	Masud9860@gmail.com	969/1 Uttara, House No: 644, Dhaka-1105	41000	01770080283
16	700350	Md Tasmim	Rahman	01578444036	Rahma6303@gmail.com	813/5 Uttara, House No: 743, Dhaka-1005	34000	01529082586
17	961072	Naima	Hasan	01787637365	Hasan1692@gmail.com	470/4 Dhanmondi, House No: 794, Dhaka-1298	27000	01991350291
18	105646	Md. Adnan	Ali	01748686164	Ali893@yahoo.com	156/7 Mogbazar, House No: 623, Dhaka-1131	36000	01761628990
19	630993	Tahmid Intiaz	Imu	01577232772	Imu3186@gmail.com	224/5 Old Dhaka, House No: 654, Dhaka-1063	88000	01931380984
20	951824	Rafid	Ahmed	01546477637	Ahmed8963@yahoo.com	978/2 Uttara, House No: 440, Dhaka-1138	87000	01960119643
21	892982	Ahsanul	Jobayer	01589606542	Jobayer746@yahoo.com	456/9 Rampura, House No: 250, Dhaka-1117	82000	01937452354
22	375802	Asif	Ahmed	01517640814	Ahmed7864@gmail.com	394/1 Rampura, House No: 805, Dhaka-1050	47000	01741775660
23	110286	Asif	Jawad	01790969540	Jawad8445@gmail.com	124/6 Khilgaon, House No: 823, Dhaka-1026	54000	01553081269

Doctors_Speciality :

	👤 speciality	👤 doctor_id
1	Cardiologist	860414
2	Surgeon	860414
3	Gynecologist	798204
4	Obstetrician	798204
5	Gastroenterologist	372273
6	Ophthalmologist	920950
7	Nephrologist	638656
8	Endocrinologist	970811
9	Urologist	476157
10	Pulmonologist	328285
11	Otolaryngologist	703141
12	Neurologist	507918
13	Psychiatrist	137214
14	Oncologist	964401
15	Radiologist	440171
16	Rheumatologist	854018
17	Surgeon	542443
18	Anesthesiologist	700350
19	Urologist	961072
20	Nephrologist	105646
21	Gynecologist	630993
22	Cardiologist	951824
23	Urologist	892982
24	Nephrologist	375802

Works For :

	👤 doctor_id	🏥 department_name	🏥 hospital_name	🏥 branch_name
1	700350	Anesthesiology	Anwer Khan Modern Hospital Ltd.	Dhanmondi
2	700350	Anesthesiology	Apollo Hospital	Basundhara
3	700350	Anesthesiology	Care Hospital Ltd.	Mohammadpur
4	700350	Anesthesiology	Delta Medical Center Ltd	Dhanmondi
5	700350	Anesthesiology	Dhaka Medical College Hospital	Puran Dhaka
6	700350	Anesthesiology	Green Eye & General Hospital	Dhanmondi
7	700350	Anesthesiology	Popular Diagnostic Center Ltd.	Uttara
8	210599	Cardiology	Popular Diagnostic Center Ltd.	Uttara
9	474675	Cardiology	Popular Diagnostic Center Ltd.	Uttara
10	951824	Cardiology	Popular Diagnostic Center Ltd.	Uttara
11	860414	Cardiology	Popular Diagnostic Center Ltd.	Dhanmondi
12	135065	Cardiology	Popular Diagnostic Center Ltd.	Dhanmondi
13	765460	Cardiology	Popular Diagnostic Center Ltd.	Dhanmondi
14	199090	Cardiology	Popular Diagnostic Center Ltd.	Dhanmondi
15	799388	Cardiology	Popular Diagnostic Center Ltd.	Dhanmondi
16	210599	Cardiology	Mirpur Adhunik Hospital	Mirpur
17	474675	Cardiology	Mirpur Adhunik Hospital	Mirpur
18	951824	Cardiology	Mirpur Adhunik Hospital	Mirpur
19	199090	Cardiology	Mirpur Adhunik Hospital	Mirpur
20	799388	Cardiology	Mirpur Adhunik Hospital	Mirpur
21	210599	Cardiology	SQUARE Hospitals Ltd.	Mirpur
22	474675	Cardiology	SQUARE Hospitals Ltd.	Mirpur
23	951824	Cardiology	SQUARE Hospitals Ltd.	Mirpur
24	860414	Cardiology	SQUARE Hospitals Ltd.	Mirpur

Patients :

	👤 patient_id	📞 patient_mobile	👤 first_name	👤 last_name	📅 date_of_birth	👤 weight	👤 gender	🏠 patient_address	📧 patient_email
1	1	3588833413	Tawsha	Ferdinand	10/28/2000	87	Male	04012 Brentwood Junction	tferdinand0@mediafire.com
2	2	5827878000	Allsun	Whatford	1/4/2006	93	Female	91 Summer Ridge Pass	awhatford1@apache.org
3	3	6917839957	Ruthann	Faircliff	5/14/1995	61	Male	1680 Dennis Court	rfaircliff2@spotify.com
4	4	4682174110	Enos	Balf	2/28/1985	97	Male	580 Browning Junction	ebalf3@businessweek.com
5	5	2875890198	Marja	Beesley	5/21/2004	59	Male	778 Meadow Ridge Center	mbeesley4@woothemes.com
6	6	4184858331	Philipa	Feehily	12/9/1993	81	Female	80 Moland Parkway	pfeeihly5@answers.com
7	7	9562848628	Doy	Kunkel	3/10/2001	77	Male	432 Mesta Trail	dkunkel6@timesonline.co.uk
8	8	3493840908	Marysa	Gallop	5/9/1992	75	Male	859 Cascade Avenue	mgallop7@dropbox.com
9	9	8779353091	Sarena	Fells	9/19/1998	50	Female	53822 Sheridan Center	sfells8@vinaora.com
10	10	5865336936	Ogdan	Noor	7/28/1970	66	Male	337 Farmco Alley	onoor9@flavors.me
11	11	9506427613	Berky	Squier	1/22/1977	100	Male	3 Sherman Lane	bsquiera@theguardian.com
12	12	8458683695	Tine	Bendig	3/17/1993	52	Male	60 Heffernan Terrace	tbendigb@cam.ac.uk
13	13	5093530837	Luce	Muff	9/25/1990	95	Female	8 Jenifer Place	lmuffc@friendfeed.com
14	14	8187590061	Kristin	Molohan	4/4/2001	73	Male	10 Morningstar Trail	kmolohanda@shutterfly.com
15	15	2518497795	Cos	Cleave	5/28/2006	95	Male	1178 Browning Parkway	ccleavee@topsy.com
16	16	7512639312	Brnaba	McCloughlin	11/22/1990	69	Female	4567 Browning Hill	bmcccloughlinf@mit.edu
17	17	2288859975	Caresa	Bullin	11/4/1991	57	Male	654 Anthes Street	cbulling@devhub.com
18	18	2922490707	Isidro	Parrot	10/28/2003	88	Male	1 Mifflin Hill	iparrot@berkeley.edu
19	19	2212785520	Ryun	Normand	4/11/1982	61	Male	76587 Sunnyside Hill	rnormandj@unc.edu
20	20	2837347443	Cornall	Vinden	2/19/1987	96	Male	2928 Parkside Trail	cvindenj@webeden.co.uk
21	21	6011202926	Jessy	Semor	10/4/2010	54	Male	9221 Wayridge Hill	jsemork@paginegialle.it
22	22	5012328562	Calida	Buske	12/21/2004	72	Male	396 Rusk Road	cbuskel@iitbeian.gov.cn
23	23	4926851803	Cristy	Cady	1/5/1971	57	Male	003 Summer Ridge Park	ccady@washington.edu

Treatment :

	department_name	hospital_name	branch_name	patient_id	patient_mobile
1	Anesthesiology	Anwer Khan Modern Hospital Ltd.	Dhanmondi	1 3588833413	
2	Anesthesiology	Apollo Hospital	Basundhara	2 5827878000	
3	Anesthesiology	Care Hospital Ltd.	Mohammadpur	3 6917839957	
4	Anesthesiology	Delta Medical Center Ltd	Dhanmondi	4 4682174110	
5	Anesthesiology	Dhaka Medical College Hospital	Puran Dhaka	5 2075890198	
6	Anesthesiology	Green Eye & General Hospital	Dhanmondi	6 4184858331	
7	Anesthesiology	Popular Diagnostic Center Ltd.	Uttara	7 9562848628	
8	Cardiology	Popular Diagnostic Center Ltd.	Uttara	8 3493840908	
9	Cardiology	Popular Diagnostic Center Ltd.	Uttara	9 8779353091	
10	Cardiology	Popular Diagnostic Center Ltd.	Uttara	10 5865336936	
11	Cardiology	Popular Diagnostic Center Ltd.	Dhanmondi	11 9506427613	
12	Cardiology	Popular Diagnostic Center Ltd.	Dhanmondi	12 8458683695	
13	Cardiology	Popular Diagnostic Center Ltd.	Dhanmondi	13 5093530837	
14	Cardiology	Popular Diagnostic Center Ltd.	Dhanmondi	14 8187590061	
15	Cardiology	Popular Diagnostic Center Ltd.	Dhanmondi	15 2518497795	
16	Cardiology	Mirpur Adhunik Hospital	Mirpur	16 7512639312	
17	Cardiology	Mirpur Adhunik Hospital	Mirpur	17 2288859975	
18	Cardiology	Mirpur Adhunik Hospital	Mirpur	18 2922490707	
19	Cardiology	Mirpur Adhunik Hospital	Mirpur	19 2212785520	
20	Cardiology	Mirpur Adhunik Hospital	Mirpur	20 2837347443	
21	Cardiology	SQUARE Hospitals Ltd.	Mirpur	21 6011202926	
22	Cardiology	SQUARE Hospitals Ltd.	Mirpur	22 5012328562	
23	Cardiology	SQUARE Hospitals Ltd.	Mirpur	23 4926851803	
24	Cardiology	SQUARE Hospitals Ltd	Mirpur	24 1477200270	

Operation :

	doctor_id	hospital_name	branch_name	patient_id	patient_mobile	date_of_operation	room_number	ap
1	860414	Mirpur Adhunik Hospital	Mirpur	20 2837347443		1/16/2010		3 4 ho
2	798204	Greenland Hospital	Uttara	19 2212785520		9/22/2019		5 3 ho
3	798204	Popular Diagnostic Center Ltd.	Uttara	53 7483290321		6/30/2015		2 5 ho
4	372273	Holy Family Red Crescent Medical College and Hospital	MoghBazar	10 5865336936		3/2/2018		3 2 ho
5	920950	Green Eye & General Hospital	Dhanmondi	38 4299455006		4/18/2010		4 4 ho
6	638656	Popular Diagnostic Center Ltd.	Uttara	14 8187590061		7/21/2017		5 2 ho
7	970811	City Hospital Ltd.	Mohammadpur	62 3254109381		5/13/2017		1 3 ho
8	476157	Apollo Hospital	Basundhara	39 4959056829		9/15/2011		4 4 ho
9	328285	Mirpur General Hospital	Mirpur	18 2922490707		10/16/2012		1 4 ho
10	703141	Labaid Specialized Hospital	Uttara	10 5865336936		3/5/2018		1 2 ho
11	507918	Mirpur General Hospital	Mirpur	11 9506427613		10/3/2014		4 6 ho
12	137214	Popular Diagnostic Center Ltd.	Dhanmondi	48 6206100975		10/29/2012		2 4 ho
13	964401	Greenland Hospital	Uttara	19 2212785520		7/19/2010		2 4 ho
14	440171	Mirpur Adhunik Hospital	Mirpur	16 7512639312		10/9/2019		4 4 ho
15	854018	Apollo Hospital	Basundhara	47 2798869578		11/14/2013		4 5 ho
16	542443	Greenland Hospital	Uttara	40 7851584146		7/3/2016		3 6 ho
17	961072	Dhaka Medical College Hospital	Puran Dhaka	61 2289064712		2/21/2014		5 3 ho
18	630993	Green Eye & General Hospital	Dhanmondi	13 5093530837		10/1/2015		2 2 ho
19	951824	Popular Diagnostic Center Ltd.	Uttara	34 4057499651		6/20/2017		2 2 ho
20	700350	Greenland Hospital	Uttara	20 2837347443		3/25/2011		2 6 ho
21	105646	Holy Family Red Crescent Medical College and Hospital	MoghBazar	57 1855454348		9/30/2011		5 6 ho
22	892982	City Hospital Ltd.	Mohammadpur	69 3294900159		10/4/2012		3 6 ho
23	375802	Dhaka Medical College Hospital	Puran Dhaka	36 3575514044		10/20/2016		5 5 ho

Bill :

	receipt_id	total_payment	bill_date	hospital_name	branch_name	patient_id	patient_mobile
1	1	5470	10/16/2020	Anwer Khan Modern Hospital Ltd.	Dhanmondi	30	1128958935
2	2	52546	12/7/2019	Apollo Hospital	Basundhara	65	6792660545
3	3	74409	6/18/2019	Care Hospital Ltd.	Mohammadpur	16	7512639312
4	4	45495	5/8/2012	City Hospital Ltd.	Mohammadpur	57	1855454348
5	5	83638	1/18/2020	Delta Medical Center Ltd	Dhanmondi	17	2288859975
6	6	5826	11/20/2016	Dhaka Community Hospital	Ramna	18	2922490707
7	7	35897	7/5/2019	Dhaka Medical College Hospital	Puran Dhaka	55	7344995078
8	8	37220	1/18/2017	Green Eye & General Hospital	Dhanmondi	43	7107715757
9	9	24244	3/16/2010	Greenland Hospital	Uttara	16	7512639312
10	10	62532	7/8/2012	Holy Family Red Crescent Medical College and Hospital	MoghBazar	1	3588833413
11	11	92212	5/21/2018	Ibn Sina Hospital	Dhanmondi	7	9562848628
12	12	50023	12/19/2013	Ibrahim Cardiac Hospital and Research Institute	Puran Dhaka	66	1057942786
13	13	51937	8/16/2015	Labaid Specialized Hospital	Puran Dhaka	6	4184858331
14	14	28339	6/23/2013	Labaid Specialized Hospital	Uttara	49	4104321982
15	15	16882	6/26/2012	Labaid Specialized Hospital	Gulshan	10	5865336936
16	16	49999	10/1/2011	Mirpur Adhunik Hospital	Mirpur	63	2126422557
17	17	81875	7/9/2017	Mirpur General Hospital	Mirpur	69	3294900159
18	18	85658	5/3/2010	Popular Diagnostic Center Ltd.	Uttara	18	2922490707
19	19	57309	4/28/2010	Popular Diagnostic Center Ltd.	Dhanmondi	39	4959056829
20	20	77627	1/26/2019	SQUARE Hospitals Ltd.	Mirpur	21	6011202926
21	21	38622	10/26/2010	SQUARE Hospitals Ltd.	Mirpur	66	1057942786
22	22	60166	9/4/2019	Popular Diagnostic Center Ltd.	Dhanmondi	33	3851402848
23	23	7098	2/8/2016	Popular Diagnostic Center Ltd.	Uttara	39	4959056829
24	24	20848	8/20/2017	Mirpur General Hospital	Mirpur	8	3603640088

Query Statement, Relational Algebra Expression, SQL Statement

/* 1. List of all the hospitals which have a specific Department */
 /* Basic Query */

```
SELECT Hospital_Name, Branch_Name
FROM Departments
WHERE Department_Name = 'Anesthesiology';
```

1. Relational Algebra Expression :

Π Hospital_Name, Branch_Name (σ Department_Name = 'Anesthesiology' (Departments))

	hospital_name	branch_name
1	Anwer Khan Modern Hospital Ltd.	Dhanmondi
2	Apollo Hospital	Basundhara
3	Care Hospital Ltd.	Mohammadpur
4	Delta Medical Center Ltd	Dhanmondi
5	Dhaka Medical College Hospital	Puran Dhaka
6	Green Eye & General Hospital	Dhanmondi
7	Greenland Hospital	Uttara
8	Holy Family Red Crescent Medical College and Hospital	MoghBazar
9	SQUARE Hospitals Ltd.	Mirpur
10	Ibrahim Cardiac Hospital and Research Institute	Puran Dhaka
11	Popular Diagnostic Center Ltd.	Dhanmondi
12	Mirpur Adhunik Hospital	Mirpur
13	Popular Diagnostic Center Ltd.	Uttara

```
/* 2. List of patients whom are having an operation on a particular date */
/* Natural Join */
```

```
SELECT P.Patient_Id, P.First_Name, P.Patient_Mobile, O.Hospital_Name, O.Branch_Name
FROM Operation AS O NATURAL JOIN Patients AS P
WHERE o.Date_of_Operation = '10/20/2016';
```

2. Relational Algebra Expression :

Π Patient_Id, First_Name, Patient_Mobile, Hospital_Name, Branch_Name (σ Date_of_Operation = '10/20/2016' (Operation \bowtie Patients))

	patient_id	first_name	patient_mobile	hospital_name	branch_name
1	23	Cristy	4926851803	Delta Medical Center Ltd	Dhanmondi
2	35	Lucille	8351752726	Popular Diagnostic Center Ltd.	Uttara
3	36	Colver	3575514044	Dhaka Medical College Hospital	Puran Dhaka
4	65	Roth	6792660545	Anwer Khan Modern Hospital Ltd.	Dhanmondi

```
/* 3. List all the Bills of a Specific Hospital and Specific Branch with Patients First Name and Total
Payment */
/* Cross product */
```

```
SELECT P.First_Name, B.Total_Payment
FROM Patients AS P, Bill AS B
WHERE P.Patient_Id = B.Patient_Id and B.Hospital_Name = 'Apollo Hospital' and B.Branch_Name =
'Basundhara';
```

3. Relational Algebra Expression :

Π First_Name, Total_Payment (σ Hospital_Name = 'Apollo Hospital' \wedge Branch_Name = 'Basundhara' (Patients \bowtie Bill))

	first_name	total_payment
1	Ogdan	20664
2	Tine	48444
3	Tine	66434
4	Benedict	65079
5	Roth	52546

```
/* 4. List of all the Patients who have no Bills yet */
/* Outer Join */
```

```
SELECT P.First_Name, P.Patient_Mobile
FROM Patients AS P NATURAL LEFT OUTER JOIN Bill AS B
WHERE B.Receipt_Id IS NULL;
```

4. Relational Algebra Expression :

Π First_Name, Patient_Mobile (Patient) – Π First_Name, Patient_Mobile (Patient \bowtie Bill)

	first_name	patient_mobile
1	Vilhelmina	8653612652
2	Luce	5093530837
3	Berky	9506427613
4	Nessie	3032239482
5	Cristy	4926851803
6	Farly	3946484253
7	Denni	4057499651
8	Evita	2798869578
9	Darby	2361801931
10	Cornall	2837347443
11	Tate	2411942642
12	Sydel	5651696336
13	Trent	2952037499
14	Marja	2075890198

/* 5. List of all the Patients who had operation in Apollo Hospital's Basundhara Branch */
/* Join with On */

```
SELECT P.First_Name, P.Patient_Mobile, O.Date_of_Operation
From Patients AS P JOIN Operation as O
ON P.Patient_Id = O.Patient_Id
where O.Hospital_Name = 'Apollo Hospital' and O.Branch_Name = 'Basundhara';
```

5. Relational Algebra Expression :

$\Pi_{\text{First_Name, Patient_Mobile, Date_Of_Operation}} (\sigma_{\text{Hospital_Name} = \text{'Apollo Hospital'} \wedge \text{Branch_Name} = \text{'Basundhara'}} (\rho_P(\text{Patients}) \bowtie \rho_O(\text{Operation})))$

	first_name	patient_mobile	date_of_operation
1	Cullen	3851402848	3/11/2018
2	Cullen	3851402848	2/15/2015
3	Denni	4057499651	7/21/2015
4	Colver	3575514044	3/25/2017
5	Vinson	4959056829	9/15/2011
6	Meredeth	4072926064	11/2/2011
7	Meredeth	4072926064	6/12/2019
8	Sonny	1679088838	10/6/2015
9	Vilhelmina	8653612652	12/5/2010
10	Evita	2798869578	11/14/2013

```
/* 6. List all the Patients who had no Operations */
/* Exists */
```

```
SELECT P.Patient_Id, P.First_Name, P.Patient_Mobile
FROM Patients AS P
WHERE NOT EXISTS(
    SELECT *
    FROM Operation AS O
    WHERE P.Patient_Id = O.Patient_Id
);
```

6. Relational Algebra Expression :

$\Pi_{\text{Patient_Id, First_Name, Patient_Mobile}} (\text{Patient}) - \Pi_{\text{Patient_Id, First_Name, Patient_Mobile}} (\text{Patient} \bowtie \text{Operation})$

	patient_id	first_name	patient_mobile
1	2	Allsun	5827878000
2	3	Ruthann	6917839957
3	6	Philipa	4184858331
4	7	Doy	9562848628
5	8	Marysa	3493840908
6	9	Sarena	8779353091
7	21	Jessy	6011202926
8	27	Farly	3946484253
9	28	Frieda	8657407343
10	29	Lynnett	2268318429
11	50	Debbi	8911157875
12	51	Trent	2952037499
13	56	Bridgette	2436661474
14	58	Sydel	5651696336
15	63	Vyky	2126422557

```
/* 7. List all the Doctors who have the max salary */
/* With and Aggregate Function Max */
```

```
WITH Max_Salary(Max_Salary) AS (
    SELECT max(Salary)
    FROM Doctors
)
SELECT Doctor_Id, First_Name, Salary
FROM Doctors AS D NATURAL JOIN Max_Salary AS M
WHERE D.Salary = M.Max_Salary;
```

	doctor_id	first_name	salary
1	742184	Kazi Shadman	130500

```
/* 8. In which operation room most of the operations are held in a Hospital*/
/* With, Group By and Aggregate Function (Max, Count) */
```

```
WITH Most_Operated_Room(Room_Number, Count) AS (
    SELECT Room_Number, count(Room_Number)
    FROM Operation
    WHERE Hospital_Name = 'Anwer Khan Modern Hospital Ltd.' and Branch_Name =
'Dhanmondi'
    GROUP BY Room_Number
)
SELECT Room_Number, Count
FROM Most_Operated_Room
WHERE Count = (
    SELECT max(Count)
    FROM Most_Operated_Room
);
```

	room_number	count
1	2	3

```
/* 9. Update a Doctor's salary and Emergency Mobile Number */
/* Update Operation, Set Operation */
```

```
UPDATE Doctors
SET Salary = 130500 , Emergency_Mobile = '01770172816'
WHERE Doctor_Id = '742184';
```

```
/* 10. Delete all the datas of receipt id = 100 */
/* Delete Operation */
```

```
DELETE FROM Bill
WHERE Receipt_Id = 100;
```



```
/* 11. Show all the Hospitals whose average payment is greater than 55000 */
/* Group By, Having, Aggregate function (avg) */
```

```
SELECT Hospital_Name, avg(Total_Payment) as Average_Payment
FROM Bill
GROUP BY Hospital_Name
HAVING avg(Total_Payment) >= 55000;
```

11. Relational Algebra Expression :

$\Pi_{\text{Hospital_Name, Average_Payment}} (\sigma_{\text{Average_Payment} > 55000} \gamma_{(\text{Hospital_Name})} \text{avg(Total_Payment)} \rightarrow \text{Average_Payment } p \text{ Bill})$

	hospital_name	average_payment
1	Ibn Sina Hospital	65054
2	Delta Medical Center Ltd	60005
3	Holy Family Red Crescent Medical College and Hospital	56581.5
4	Green Eye & General Hospital	68470.6
5	Mirpur Adhunik Hospital	69024.2

```
/* 12. List all the total operations done by all the doctors in decreasing order */
/* With, aggregate function (count), Group By, Natural Join, Order By */
```

```
WITH Most_Operation_Done_By_A_Doctor(Doctor_Id, Count) AS (
    SELECT Doctor_Id, count(Doctor_Id)
    FROM Operation
    GROUP BY Doctor_Id
)
SELECT MODBAD.Doctor_Id, D.First_Name, D.Last_Name, D.Doctor_Mobile, MODBAD.Count
FROM Most_Operation_Done_By_A_Doctor AS MODBAD NATURAL JOIN Doctors AS D
ORDER BY Count DESC;
```

	doctor_id	first_name	last_name	doctor_mobile	count
1	309781	K.M. Azwad	Hossain	01565928199	3
2	184678	Ahmed Zaman	Pranta	01734456284	3
3	650740	Jaian Ahnaf	Rahim	01745409324	3
4	437045	Md. Tawhidul	Islam	01774109712	3
5	332870	Sayan Sadman	Arnob	01967370438	3
6	860414	Tahmid	Mosaddek	01587628266	3
7	104479	Md. Sakib-UL-Rahman	Sourove	01991939551	3
8	135065	Md. Musfikur	Hasa	01986190464	2
9	838434	Md. Nurul	Islam	01735008812	2
10	363079	Prodipta Sen	Amartya	01768643930	2
11	765460	Fariha Tanjim	Shifat	01781935550	2
12	199090	Ashikur	Rahman	01913837338	2
13	621734	Ahnaf	Tahmid	01786671995	2
14	617617	Sakib Hasan	Plabon	01968379900	2

/* 13. List all the Hospitals which have more payment amount than Dhaka Medical College Hospital Branch Puran Dhaka*/
 /* All */

```
SELECT *
FROM Bill AS B1
WHERE B1.Total_Payment > All (
    SELECT B2.Total_Payment
    From Bill AS B2
    WHERE B2.Hospital_Name = 'Dhaka Medical College Hospital' and B2.Branch_Name = 'Puran
Dhaka'
);
```

	receipt_id	total_payment	bill_date	hospital_name	branch_name	patient_id	patient_mobile
1	3	74409	6/18/2019	Care Hospital Ltd.	Mohammadpur	16	7512639312
2	5	83638	1/18/2020	Delta Medical Center Ltd	Dhanmondi	17	2288859975
3	11	92212	5/21/2018	Ibn Sina Hospital	Dhanmondi	7	9562848628
4	17	81875	7/9/2017	Mirpur General Hospital	Mirpur	69	3294980159
5	18	85658	5/3/2018	Popular Diagnostic Center Ltd.	Uttara	18	2922498787
6	20	77627	1/26/2019	SQUARE Hospitals Ltd.	Mirpur	21	6011202926
7	25	96381	8/6/2020	Mirpur Adhunik Hospital	Mirpur	7	9562848628
8	27	81718	11/23/2012	Labaid Specialized Hospital	Uttara	50	8911157875
9	44	79115	10/5/2011	City Hospital Ltd.	Mohammadpur	26	5937412190
10	45	84690	2/9/2011	Delta Medical Center Ltd	Dhanmondi	45	1679888838
11	46	99182	3/21/2013	Dhaka Community Hospital	Ramna	26	5937412190
12	48	88586	11/8/2016	Green Eye & General Hospital	Dhanmondi	19	2212785520
13	56	87170	1/29/2010	Mirpur Adhunik Hospital	Mirpur	52	6124321380
14	57	77564	6/9/2011	Mirpur General Hospital	Mirpur	19	2212785520
15	59	95239	2/5/2012	Popular Diagnostic Center Ltd.	Dhanmondi	53	7483290321
16	60	77053	6/16/2010	SQUARE Hospitals Ltd.	Mirpur	56	2436661474
17	67	82960	8/28/2014	Labaid Specialized Hospital	Uttara	29	2268318429
18	69	94164	6/15/2019	Ibrahim Cardiac Hospital and Research Institute	Puran Dhaka	4	4682174110
19	73	98653	8/1/2013	Green Eye & General Hospital	Dhanmondi	65	6792668545
20	78	93064	9/4/2014	Care Hospital Ltd.	Mohammadpur	25	5669937410
21	81	85066	7/22/2017	Anwer Khan Modern Hospital Ltd.	Dhanmondi	7	9562848628
22	85	81183	12/12/2015	Delta Medical Center Ltd	Dhanmondi	15	2518497795
23	88	99866	4/11/2012	Green Eye & General Hospital	Dhanmondi	64	3467874733
24	98	91262	1/29/2020	Holy Family Red Crescent Medical College and Hospital	MoghBazar	39	4959856829

/* 14. List of which Doctor has more Salary than some other doctors whose Salary is also more than 120000 Salary */
 /* Some, Order By */

```
SELECT D1.Doctor_Id, D1.First_Name, D1.Last_Name, D1.Salary
FROM Doctors AS D1
WHERE D1.Salary > SOME (
    SELECT D2.Salary
    FROM Doctors AS D2
    WHERE D2.Salary > 120000
)
ORDER BY Salary Desc;
```

	doctor_id	first_name	last_name	salary
1	742184	Kazi Shadman	Sakib	130500
2	703141	Shamuel Chowdhury	Siam	126000
3	448634	Mushahid	Intesum	126000
4	474675	Md.	Fahim	126000
5	765460	Fariha Tanjim	Shifat	123000

Create Views and use those Views in Answering Queries.

/* 15. Create a view of all the Doctors who works for Cardiology department of Dhaka Medical College Hospital Branch Puran Dhaka */
/* View */

```
CREATE VIEW Cardiology_Department_DMC AS  
SELECT D.Doctor_Id, D.First_Name, D.Last_Name, D.Doctor_Mobile  
FROM Doctors AS D NATURAL JOIN Works_For AS WF  
WHERE WF.Department_Name = 'Cardiology' and WF.Hospital_Name = 'Dhaka Medical College  
Hospital' and Branch_Name = 'Puran Dhaka';
```

	doctor_id	first_name	last_name	doctor_mobile
1	860414	Tahmid	Mosaddek	01587628266
2	799388	B.M. Obaydur	Rahman	01523299162
3	765460	Fariha Tanjim	Shifat	01781935550
4	135065	Md. Musfikur	Hasa	01986190464
5	199090	Ashikur	Rahman	01913837338

```
/* 16. Create a view of Doctors who has more than 100000 Salary */  
/* View */
```

```
CREATE VIEW More_Than_100000_Salary AS  
SELECT Doctor_Id, First_Name, Salary  
FROM Doctors  
WHERE Salary > 100000;
```

	doctor_id	first_name	salary
1	920950	Abdul Mohaimen	107000
2	638656	Prothito Shovon	112000
3	970811	Umaar Abdullah	108000
4	328285	Md. Mainul Islam	109000
5	703141	Shamuel Chowdhury	126000
6	507918	Mohidul Haque	118000
7	137214	Alif	118000
8	448634	Mushahid	126000
9	876544	Jubaear	117000
10	309781	K.M. Azwad	115000
11	650740	Jaian Ahnaf	118000
12	474675	Md.	126000
13	592157	Sakhaouth	109000
14	754606	S.M. Nayeemul	116000
15	939627	Fabiha	111000
16	320320	Md. Tahrir	108000
17	765460	Fariha Tanjim	123000
18	745798	Abir Mahmud	107000
19	120785	Md. Rizwanul	102000
20	109933	Mahnaz	105000
21	910358	Md. Ibrahim	115000
22	376685	Md. SharifulIslam	121000
23	256476	Dipok	101000
24	924216	Ather Nur	102000

List of Non-Trivial Functional Dependencies

Hospital_Branch :

$F = \{ (\text{Hospital_Name}, \text{Branch_Name}) \rightarrow (\text{City}, \text{Road_Number}, \text{Street}, \text{Postal_Code}, \text{Branch_Phone}) \}$

Departments :

$F = \{ (\text{Department_Name}, \text{Hospital_Name}, \text{Branch_Name}) \rightarrow (\text{Building Number}, \text{Department_Phone_Number}) \}$

Doctors :

$F = \{ \text{Doctor_Id} \rightarrow (\text{First_Name}, \text{Last_Name}, \text{Doctor_Mobile}, \text{Doctor_Email}, \text{Doctor_Address}, \text{Salary}, \text{Emergency Number}) \}$

Doctors_Speciality :

No Non-Trivial Functional Dependency is found here.

Patients :

$F = \{ (\text{Patient_Id}, \text{Patient_Mobile}) \rightarrow (\text{First_Name}, \text{Last_Name}, \text{Date_of_Birth}, \text{Weight}, \text{Gender}, \text{Patient_Address}, \text{Patient_Email}, \text{Height}, \text{Secondary_Number}) \}$

Works For :

No Non-Trivial Functional Dependency is found here.

Operation :

$F = \{ (\text{Doctor_Id}, \text{Hospital_Name}, \text{Branch_Name}, \text{Patient_Id}, \text{Patient_Mobile}) \rightarrow (\text{Date_of_Operation}, \text{Room_Number}, \text{Approximate_Duration}) \}$

Bill :

$F = \{ \text{Receipt_Id} \rightarrow (\text{Total_Payment}, \text{Bill_Date}, \text{Hospital_Name}, \text{Branch_Name}, \text{Patient_Id}, \text{Patient_Mobile}) \}$

Treatment :

No Non-Trivial Functional Dependency is found here.

Proof that the Schemas are in Desired Normal Forms

A schema is in BCNF if and only if at least one of the following holds :-

- i) $\alpha \rightarrow \beta$ is trivial Functional Dependency, where $\beta \subseteq \alpha$.
- ii) α is a Super key for schema R

Hospital_Branch :

$F = \{ (\text{Hospital_Name}, \text{Branch_Name}) \rightarrow (\text{Hospital_Name}, \text{Branch_Name}, \text{City}, \text{Road_Number}, \text{Street}, \text{Postal_Code}, \text{Branch_Phone}) \}$

This schema/table is in BCNF, because (Hospital_Name, Branch_Name) is a Super key and there is no other Non-Trivial Functional Dependency where L.H.S is not a Super key.

Departments :

$F = \{ (\text{Department_Name}, \text{Hospital_Name}, \text{Branch_Name}) \rightarrow (\text{Department_Name}, \text{Hospital_Name}, \text{Branch_Name}, \text{Building_Number}, \text{Department_Phone_Number}) \}$

This schema/table is in BCNF, because (Department_Name, Hospital_Name, Branch_Name) is a Super key and there is no other Non-Trivial Functional Dependency where L.H.S is not a Super key.

Doctors :

$F = \{ \text{Doctor_Id} \rightarrow (\text{Doctor_Id}, \text{First_Name}, \text{Last_Name}, \text{Doctor_Mobile}, \text{Doctor_Email}, \text{Doctor_Address}, \text{Salary}, \text{Emergency_Mobile}) \}$

This schema/table is in BCNF, because (Doctor_Id) is a Super key and there is no other Non-Trivial Functional Dependency where L.H.S is not a Super key.

Patients :

$F = \{ (\text{Patient_Id}, \text{Patient_Mobile}) \rightarrow (\text{Patient_Id}, \text{Patient_Mobile}, \text{First_Name}, \text{Last_Name}, \text{Date_of_Birth}, \text{Weight}, \text{Gender}, \text{Patient_Address}, \text{Patient_Email}, \text{Height}, \text{Secondary_Number}) \}$

This schema/table is in BCNF, because (Patient_Id, Patient_Mobile) is a Super key and there is no other Non-Trivial Functional Dependency where L.H.S is not a Super key.

Operation :
$$F = \{ (\text{Doctor_Id}, \text{Hospital_Name}, \text{Branch_Name}, \text{Patient_Id}, \text{Patient_Mobile}) \rightarrow (\text{Doctor_Id}, \text{Hospital_Name}, \text{Branch_Name}, \text{Patient_Id}, \text{Patient_Mobile}, \text{Date_of_Operation}, \text{Room_Number}, \text{Approximate_Duration}) \}$$

This schema/table is in BCNF, because (Doctor_Id, Hospital_Name, Branch_Name, Patient_Id, Patient_Mobile) is a Super key and there is no other Non-Trivial Functional Dependency where L.H.S is not a Super key.

Bill :
$$F = \{ \text{Receipt_Id} \rightarrow (\text{Receipt_Id}, \text{Total_Payment}, \text{Bill_Date}, \text{Hospital_Name}, \text{Branch_Name}, \text{Patient_Id}, \text{Patient_Mobile}) \}$$

This schema/table is in BCNF, because (Receipt_Id) is a Super key and there is no other Non-Trivial Functional Dependency where L.H.S is not a Super key.

Thus, all the schemas are in BCNF. So, we can say that all the schemas are in desired normal forms.

Conclusion

This report shows us the demonstration of a Hospital Database Management System. This Database Management System shows us how the information of many types of data are stored in the Database and how beautifully all the information are connected to each other growing through multiple schemas. This Database provides accurate method for inserting, deleting and updating data from various schemas and a more effective system of data processing for retrieving data from the interconnected tables. This database takes care of all the requirements of an average hospital and is capable to provide easy and effective storage of information related to Patients that come up to the hospital.

This hospital database is developed for the hospital enterprise to store all the data of Doctors, Patients, Operations that they have operated individually, Bills that they charge to Patients or Bills that a individual Patient is getting. Also we can retrieve various information like which Patient is getting treatment from which department of a Hospital, which Doctor is serving in which Hospital ect.

The proposed system can be enhanced by including more facilities like pharmacy system for the stock details of medicines in the pharmacy. Providing such features enables the users to include more contents into the system.

Thank you.