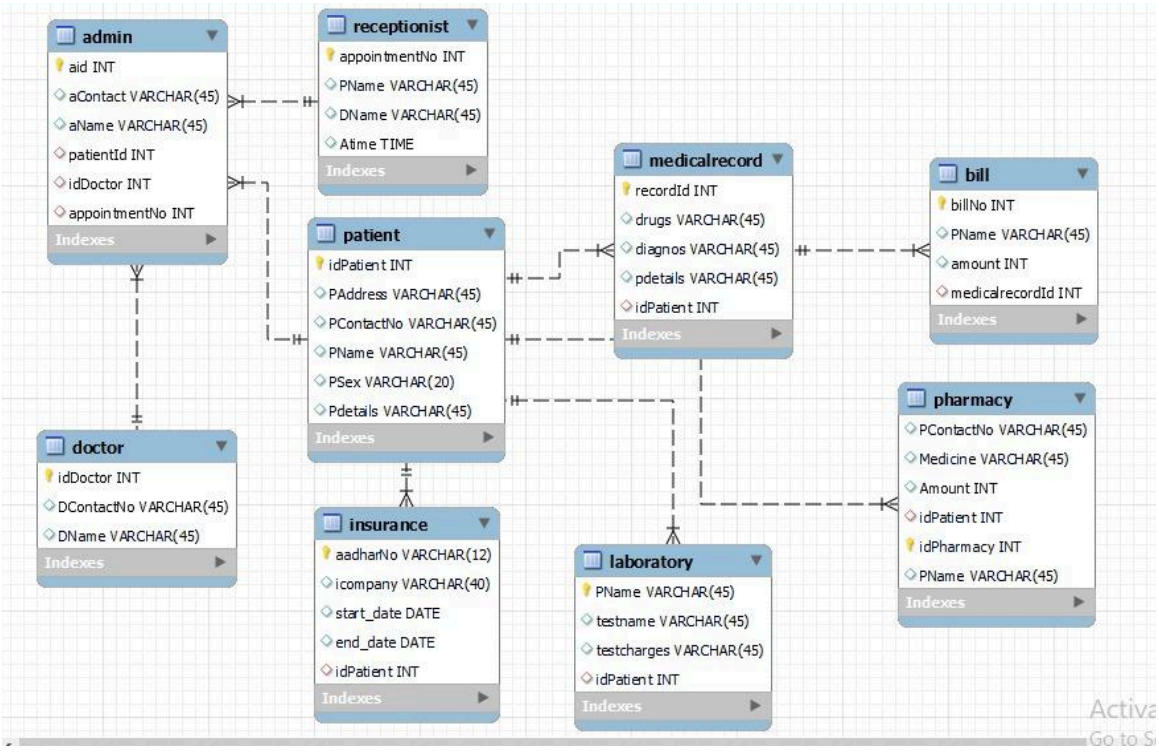
- Defining the schema diagram for the Hospital management system.

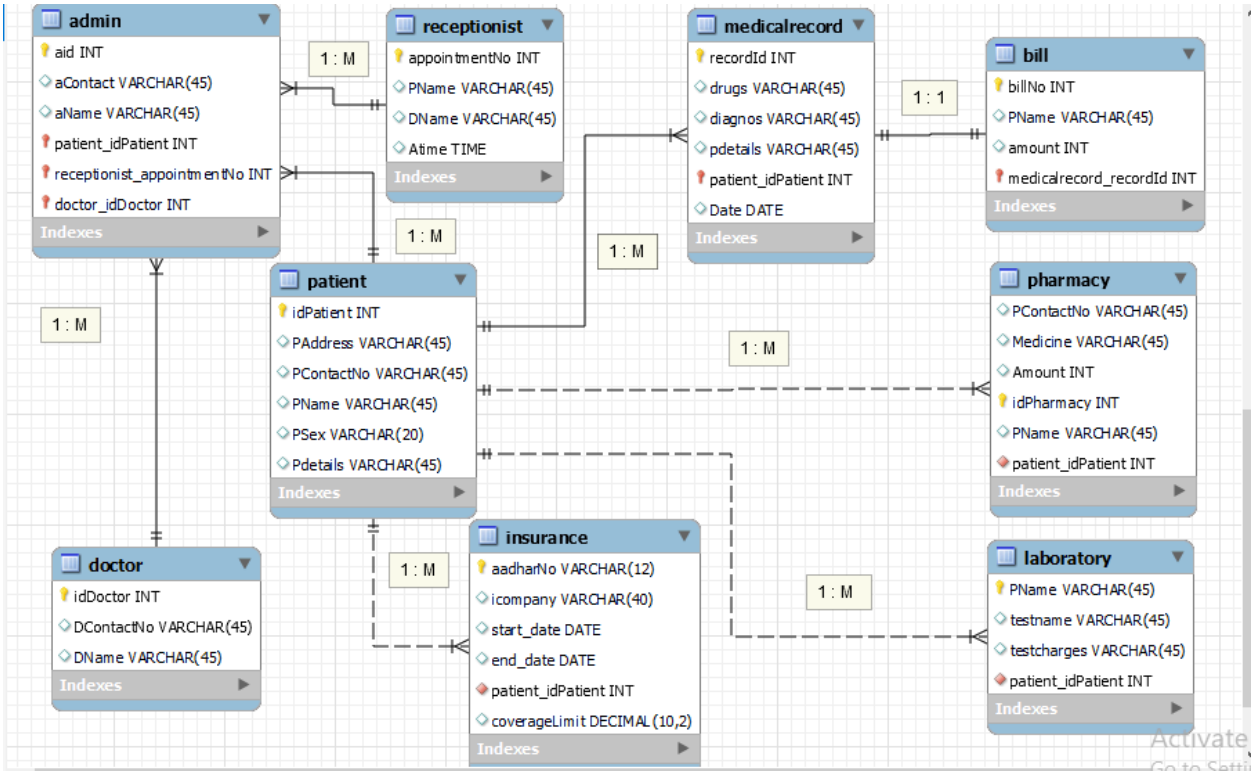
For this i referred various available schema diagram for hospital management system.I designed two versions of the schema diagram. Version 1 of the hospital system keeps things simple but repeats information. Version 2 is organized more efficiently by separating data into different parts, making it neater and preventing mistakes. The second version is normalized form of HMS.

- Step 1: I decided total 9 tables for the HMS. i.e. Admin, Patient, Doctor, receptionist, medicalrecord, bill, pharmacy, insurance, laboratory.



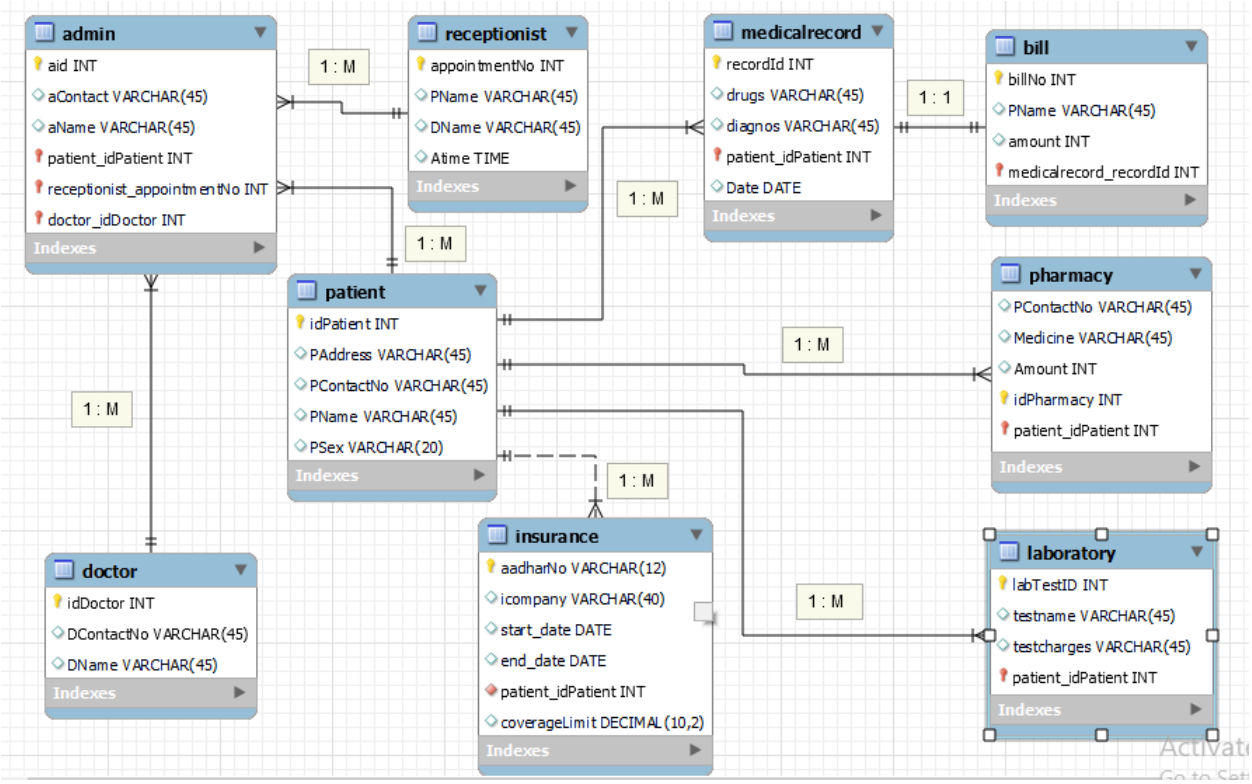
Deciding how many tables should be there in the DB

- Step 2 : Defining the relationships between these 9 tables. i.e.(1:1, 1:M, M:1, M:M)



Schema_Version 1

- Step 3 : Now we can see that the there is redundancy of some attributes like **“PatientName”** from Laboratory and Pharmacy tables and **"patient_details"** from MedicalRecord and Patient table.Hence we need to normalize the DB.



Schema_Version 2_ Normalized

Changes applied to Schema_Version 1 to get the normalized form -

1) Removed "patient_details" from MedicalRecord and Patient table
2) Removed “PatientName” from Laboratory and Pharmacy tables
3) Introduced “labTestID” as primary key of the laboratory table

- Queires

1) Write necessary queries to register new user roles and personas

```
277 •  INSERT INTO patient (idPatient, PAddress, PContactNo, PName, PSex)
278    VALUES
279    (11, '123 Main Street, Mumbai, India', '+91 9876543210', 'Aarav Patel', 'Male'),
280    (12, '456 Street Avenue, Delhi, India', '+91 8765432109', 'Zara Singh', 'Female'),
281    (13, '789 Garden Road, Bangalore, India', '+91 7654321098', 'Ishaan Sharma', 'Male'),
282    (14, '101 River View, Kolkata, India', '+91 6543210987', 'Anaya Gupta', 'Female'),
283    (15, '234 Hillside Lane, Chennai, India', '+91 5432109876', 'Vihaan Kapoor', 'Male'),
284    (16, '567 Skyline Plaza, Hyderabad, India', '+91 4321098765', 'Avani Mehra', 'Female'),
285    (17, '890 Lakeside Drive, Pune, India', '+91 3210987654', 'Arjun Reddy', 'Male'),
286    (18, '1122 Valley Street, Ahmedabad, India', '+91 2109876543', 'Kavya Patel', 'Female'),
287    (19, '334 Park Avenue, Jaipur, India', '+91 1098765432', 'Advait Kumar', 'Male'),
288    (20, '556 Mountain View, Chandigarh, India', '+91 9876543210', 'Myra Choudhary', 'Female');
289
```

Output

Action Output

#	Time	Action	Message	Duration / Fetch
34	04:39:41	UPDATE medicalrecord SET date = '2024-02-14' WHERE idPatient = 10	1 row(s) affected Rows matched: 1 Changed: 1 Warnings: 0	0.000 sec
35	04:42:26	INSERT INTO patient (idPatient, PAddress, PContactNo, PName, PSex) VALUES (11, '123 ...	10 row(s) affected Records: 10 Duplicates: 0 Warnings: 0	0.000 sec


```
290 •  select * from patient
291
```

Result Grid | Filter Rows: | Edit: | Export/Import: | Wrap Cell Content:

idPatient	PAddress	PContactNo	PName	PSex
11	123 Main Street, Mu...	+91 98765...	Aarav Patel	Male
12	456 Street Avenue, ...	+91 87654...	Zara Singh	Female
13	789 Garden Road, Ba...	+91 76543...	Ishaan Sharma	Male
14	101 River View, Kolka...	+91 65432...	Anaya Gupta	Female
15	234 Hillside Lane, Ch...	+91 54321...	Vihaan Kapoor	Male
16	567 Skyline Plaza, Hy...	+91 43210...	Avani Mehra	Female
17	890 Lakeside Drive, P...	+91 32109...	Arjun Reddy	Male
18	1122 Valley Street, A...	+91 21098...	Kavya Patel	Female

2) Write necessary queries to add to the list of diagnosis of the patient tagged by date.

```
292 •  select * from medicalrecord;
293
294 •  INSERT INTO medicalrecord (drugs, diagnos, pdetails, idPatient, date)
295    VALUES ('Paracetamol, Ibuprofen', 'Fever', 'Patient complaints of high temperature', 11, '2024-02-01');
296
297
298
```

Result Grid | Filter Rows: | Edit: | Export/Import: | Wrap Cell Content:

recordId	drugs	diagnos	pdetails	idPatient	date
1	Paracetamol	Common Cold	Prescription for flu symptoms	1	2024-02-05
2	Aspirin	Headache	Prescription for headache relief	2	2024-02-06
3	Amoxicillin	Sinus Infection	Prescription for antibiotic	3	2024-02-07
4	Ibuprofen	Back Pain	Prescription for pain management	4	2024-02-08
5	Omeprazole	Acid Reflux	Prescription for digestive issues	5	2024-02-09
6	Metformin	Diabetes	Prescription for diabetes control	6	2024-02-10
7	Atorvastatin	High Cholesterol	Prescription for cholesterol control	7	2024-02-11
8	Losartan	Hypertension	Prescription for blood pressure	8	2024-02-12

medicalrecord 6 ×

```
294 •  INSERT INTO medicalrecord (drugs, diagnos, pdetails, idPatient, date)
295    VALUES ('Paracetamol, Ibuprofen', 'Fever', 'Patient complaints of high temperature', 11, '2024-02-01');
296
297 •  select * from medicalrecord
298
```

Result Grid | Filter Rows: | Edit: | Export/Import: | Wrap Cell Content:

recordId	drugs	diagnos	pdetails	idPatient	date
15	NULL	NULL	NULL	NULL	2024-02-09
16	NULL	NULL	NULL	NULL	2024-02-10
17	NULL	NULL	NULL	NULL	2024-02-11
18	NULL	NULL	NULL	NULL	2024-02-12
19	NULL	NULL	NULL	NULL	2024-02-13
20	NULL	NULL	NULL	NULL	2024-02-14
21	Paracetamol, ...	Fever	Patient complaints of high temper...	11	2024-02-01
NULL	NULL	NULL	NULL	NULL	NULL

2024-02-14

medicalrecord 7 | medicalrecord 8 ×

3) Write necessary queries to fetch required details of a particular patient.

```
299 •  select * from patient where idPatient='1';
300
```

Result Grid | Filter Rows: | Edit: | Export/Import: | Wrap Cell Content:

idPatient	PAddress	PContactNo	PName	PSex
1	123 Main Street	9876543210	Aarav Sharma	Male
NULL	NULL	NULL	NULL	NULL

```
301 •  select * from patient where PName='Aarav Sharma';
302
```

Result Grid | Filter Rows: | Edit: | Export/Import: | Wrap Cell Content:

idPatient	PAddress	PContactNo	PName	PSex
1	123 Main Street	9876543210	Aarav Sharma	Male
NULL	NULL	NULL	NULL	NULL

4)Write necessary queries to prepare bill for the patient at the end of checkout

```
303 •  Select
304        p.idPatient,
305        p.PName,
306        p.PAddress,
307        p.PContactNo,
308        SUM(m.Amount) AS totalBill
309    from
310        patient p
311    join
312        pharmacy m ON p.idPatient = m.idPatient
313    where
314        p.idPatient = 1;
315
```

Result Grid | Filter Rows: | Export: | Wrap Cell Content:

idPatient	PName	PAddress	PContactNo	totalBill
1	Aarav Sharma	123 Main Street	9876543210	50

5)Write necessary queries to fetch and show data from various related tables (Joins)

```
303 •  select
304        p.idPatient,
305        p.PName,
306        p.PAddress,
307        p.PContactNo,
308        m.recordID,
309        m.drugs,
310        m.diagnos,
311        m.pdetails,
312        m.date
313    from
314        patient p
315    join
316        medicalrecord m ON p.idPatient = m.idPatient
317    where
318        p.idPatient = 1;
```

Result Grid | Filter Rows: | Export: | Wrap Cell Content:

idPatient	PName	PAddress	PContactNo	recordID	drugs	diagnos	pdetails	date
1	Aarav Sharma	123 Main Street	9876543210	1	Paracetamol	Common Cold	Prescription for flu symptoms	2024-02-05

6) Optimize repeated read operations using views/materialized views.

```
371 •  CREATE VIEW patient_view AS
372    SELECT
373        idPatient,
374        PName,
375        PAddress,
376        PContactNo,
377        PSex
378    FROM
379        patient;
380
381 •  SELECT * FROM patient_view WHERE PName = 'Aarav Sharma';
```

Result Grid | Filter Rows: | Export: | Wrap Cell Content:

idPatient	PName	PAddress	PContactNo	PSex
1	Aarav Sharma	123 Main Street	9876543210	Male

7) Optimize read operations using indexing wherever required. (Create index on at least 1 table)

- Without indexing:

```
394 •  SET profiling=1;
395 •  select * from medicalrecord where recordid='1';
396 •  SHOW PROFILES;
397
```

Result Grid | Filter Rows: | Export: | Wrap Cell Content:

Query_ID	Duration	Query
1	0.00433250	SHOW WARNINGS
2	0.00061050	select * from medicalrecord where recordid='...
3	0.00048000	SET profiling=1
4	0.00461100	SHOW WARNINGS
5	0.00406375	select * from medicalrecord where recordid='...

- With indexing:

```
399 •  SET profiling=1;
400 •  CREATE INDEX idx_medicalrecord_recordID ON medicalrecord (recordid);
401 •  SHOW PROFILES;
```

Result Grid | Filter Rows: | Export: | Wrap Cell Content:

Query_ID	Duration	Query
1	0.00433250	SHOW WARNINGS
2	0.00061050	select * from medicalrecord where recordid='1' ...
3	0.00048000	SET profiling=1
4	0.00461100	SHOW WARNINGS
5	0.00406375	select * from medicalrecord where recordid='1' ...
6	0.00034925	SET profiling=1
7	0.00522825	SHOW WARNINGS
8	0.10496325	CREATE INDEX idx_medicalrecord_recordID ON ...

8) Try optimizing bill generation using stored procedures.

```
DELIMITER //

CREATE PROCEDURE generateBillForMedicalRecord(IN recordid INT)
BEGIN
    DECLARE totalAmount INT;
    SELECT COALESCE(SUM(charges), 0)
    INTO totalAmount
    FROM medicalrecord
    WHERE recordid = recordid;

    -- Insert the generated bill into the 'bill' table
    INSERT INTO bill (recordid, Patient_name, amount)
    SELECT
        m.recordid,
        p.PName,
        totalAmount
    FROM
        medicalrecord m
    INNER JOIN
        patient p ON m.idPatient = p.idPatient
```

9) Add necessary triggers to indicate when patients medical insurance limit has expired.

```
CREATE TRIGGER before_insert_medicalrecord
BEFORE INSERT ON medicalrecord
FOR EACH ROW
BEGIN
    DECLARE insurance_limit DECIMAL(10,2);

    -- Get the insurance coverage limit for the patient
    SELECT coverageLimit
    INTO insurance_limit
    FROM insurance
    WHERE idPatient = NEW.idPatient;

    -- Check if the coverage limit is exceeded
    IF insurance_limit <= 0 THEN
        SIGNAL SQLSTATE '45000'
        SET MESSAGE_TEXT = 'Insurance coverage limit exceeded. Cannot insert medical record.';
    END IF;
END

DELIMITER ;
```

Output

Action Output

#	Time	Action	Message	Duration / Fetch
15	05:50:16	CREATE TRIGGER before_insert_medicalrecord BEFORE INSERT ON medicalrecord FOR ...	0 row(s) affected	0.016 sec
16	05:50:16	CREATE TRIGGER before_update_medicalrecord BEFORE UPDATE ON medicalrecord FO...	0 row(s) affected	0.015 sec

References -

https://medium.com/@sarahalalawi0/hospital-management-database-3d19dc240446
https://www.w3schools.com/sql/sql_view.asp

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