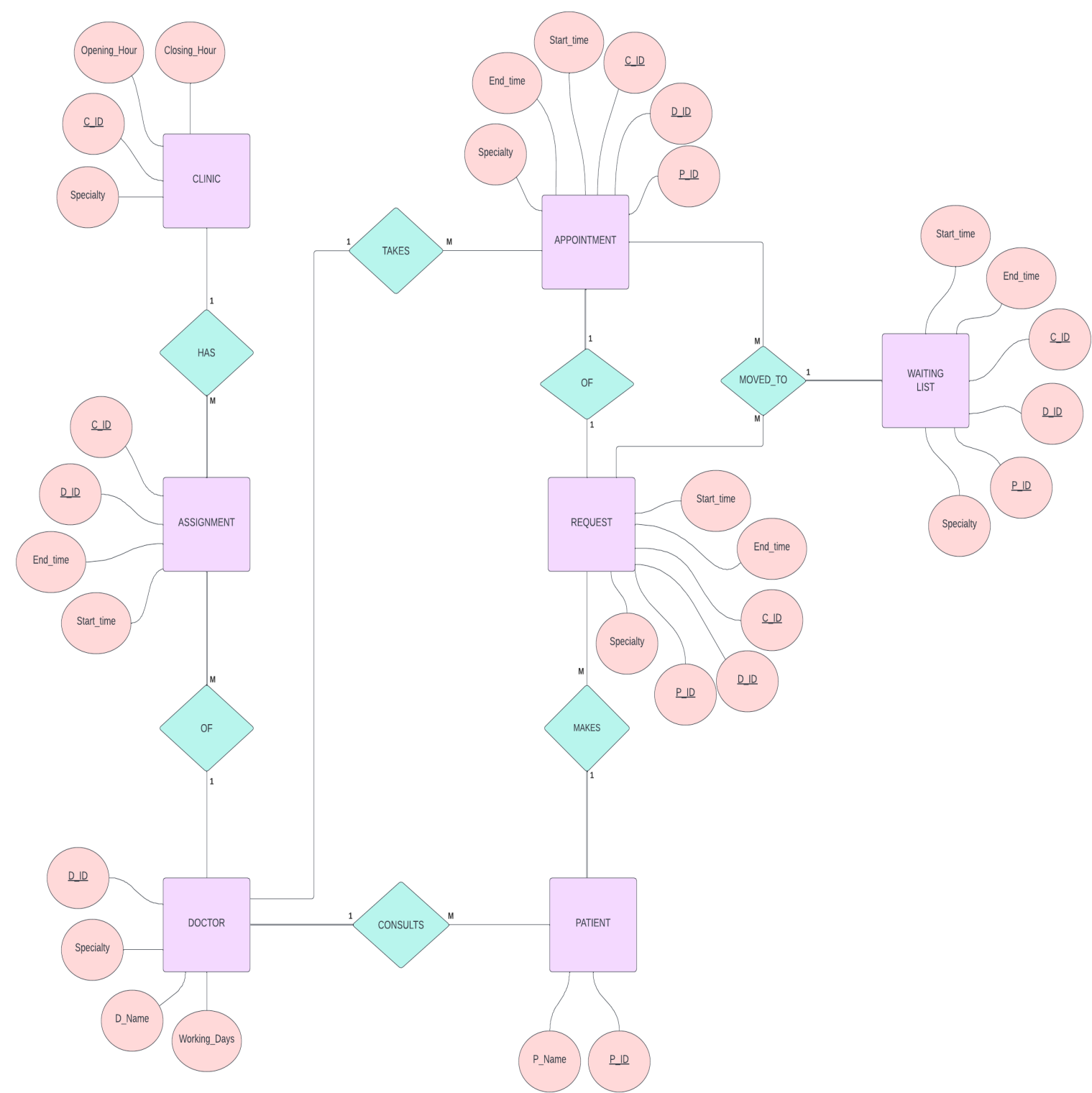**CS-2005 DATABSE SYSTEMS**

ASSIGNMENT 3

SUBMITTED BY: i20-0813 Saba Karim, i20-0967 Alina Aftab

SECTION: BS(CS) - G

SUBMITTED TO: Ma'am Ifrah Qaiser

ER DIAGRAM

SOFTWARE USED: LUCID CHARTS

REALTIONAL DATABSE SCHEMA

CLINIC

C_ID	Open_Hours	Close_Hours	C_Speciality

DOCTOR

D_ID	D_Name	D_Speciality	Days

ASSIGNMENT

C_ID	D_ID	Ass_S_Time	Ass_E_Time

PATIENT

P_ID	P_Name

APPOINTMNET

Ap_E_Time	Ap_S_Time	Ap_Spec	Ap_PID	Ap_DID	Ap_CID

REQUEST

Rq_E_Time	Rq_S_Time	Rq_Spec	Rq_PID	Rq_DID	Rq_CID
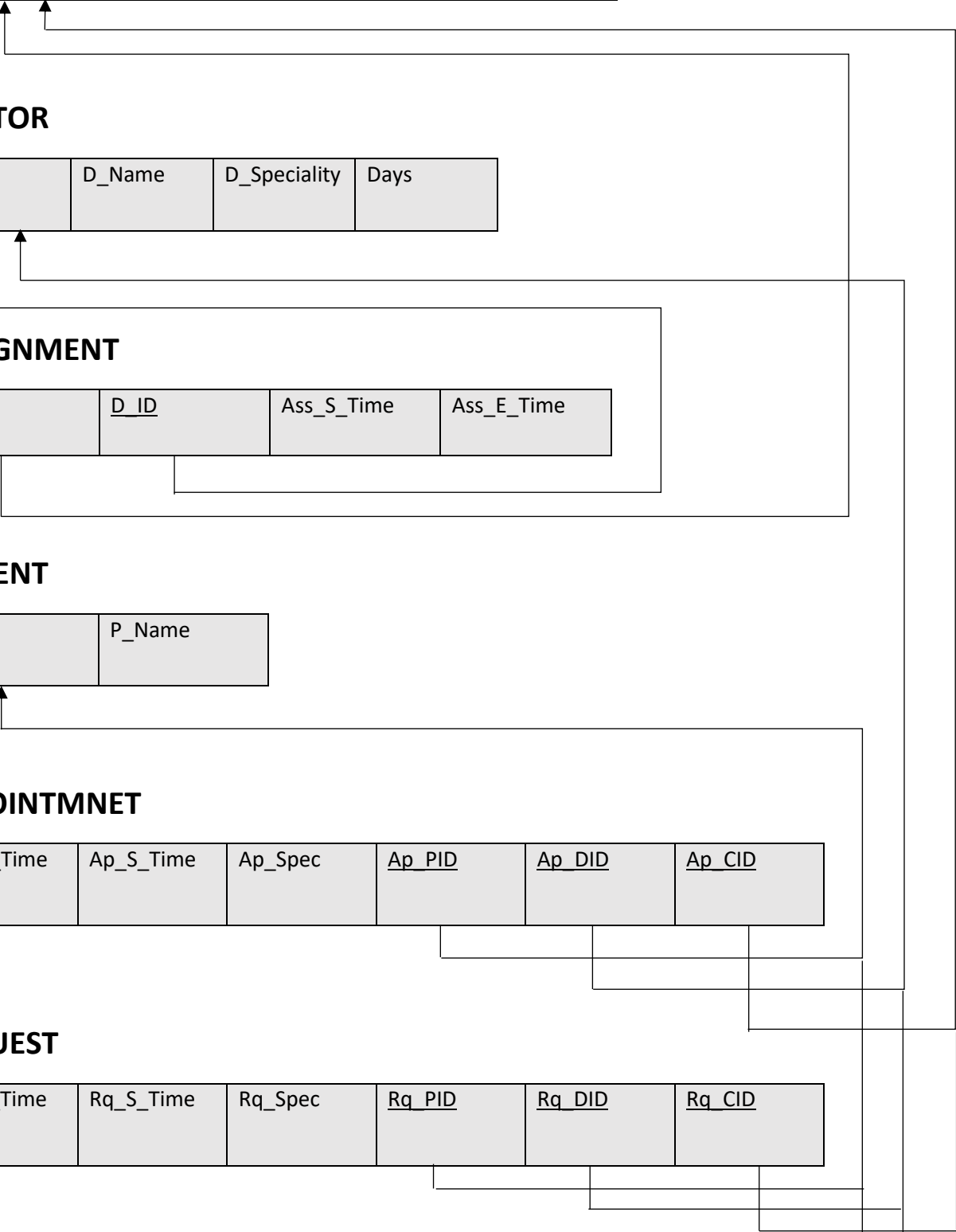
WAITING_LIST

WL_E_Time	WL_S_Time	WL_Spec	WL_PID	WL_DID	WL_CID

SQL QUERIES

```
212   --QUERY 1
213   SELECT DISTINCT A.AP_CID,P_Name
214   FROM PATIENT P
215   JOIN APPOINTMENT A ON P.P_ID = A.AP_PID
216   WHERE A.AP_CID = 1;
217
```

20 %

Results Messages

	AP_CID	P_Name
1	1	Ahmed
2	1	Ayesha
3	1	Karim
4	1	Saba

```
218   --Query 2
219   SELECT A.AP_SPEC , P.P_NAME FROM APPOINTMENT A INNER JOIN PATIENT P ON
220   P.P_ID = A.AP_PID
221   WHERE A.AP_SPEC = 'Cardiologist';
222
```

120 %

Results Messages

	AP_SPEC	P_NAME
1	Cardiologist	Saba
2	Cardiologist	Karim
3	Cardiologist	Karim

```sql
--Query 3
SELECT A.AP_PID AS 'Patient ID',P.P_NAME AS 'Patient Name', A.AP_DID AS 'Doctor ID' FROM APPOINTMENT A
INNER JOIN PATIENT P ON
P.P_ID = A.AP_PID ;
```

	Patient ID	Patient Name	Doctor ID
1	1	Saba	2
2	2	Ayesha	2
3	3	Ahmed	2
4	3	Ahmed	4
5	5	Karim	1
6	5	Karim	2
7	5	Karim	3
8	5	Karim	7

```sql
--QUERY 4
SELECT * FROM ASSIGNMENT
WHERE ASS_S_TIME ='13:00:00'
AND ASS_E_TIME = '14:00:00';
```

	ASS_S_TIME	ASS_E_TIME	ASS_CID	ASS_DID
1	13:00:00.0000000	14:00:00.0000000	1	1
2	13:00:00.0000000	14:00:00.0000000	1	2
3	13:00:00.0000000	14:00:00.0000000	1	8
4	13:00:00.0000000	14:00:00.0000000	5	3
5	13:00:00.0000000	14:00:00.0000000	6	5

```sql
--Query 5
SELECT D1.D_NAME AS 'Doctor Name', D1.D_SPECIALITY AS 'Speciality', A1.ASS_S_TIME AS 'Start Time',
A1.ASS_E_TIME AS 'End Time', D1.DAYS, D2.D_NAME AS 'Doctor Name', D2.D_SPECIALITY AS 'Speciality',
A2.ASS_S_TIME AS 'Start Time', A2.ASS_E_TIME AS 'End Time', D2.DAYS FROM DOCTOR D1
JOIN DOCTOR D2 ON D1.D_SPECIALITY = D2.D_SPECIALITY  --speciality of both doctors should match
JOIN ASSIGNMENT A1 ON A1.ASS_DID = D1.D_ID --checking assignment of doctor
JOIN ASSIGNMENT A2 ON A2.ASS_DID = D2.D_ID

WHERE (D1.DAYS = D2.DAYS) AND (D1.D_ID != D2.D_ID) AND (A1.ASS_CID = A2.ASS_CID) AND
(A1.ASS_S_TIME = A2.ASS_S_TIME) AND (A1.ASS_E_TIME = A2.ASS_E_TIME) ;
```

	Doctor Name	Speciality	Start Time	End Time	DAYS	Doctor Name	Speciality	Start Time	End Time	DAYS
1	Saba	Dermatology	13:00:00.0000000	14:00:00.0000000	Tuesday	Sara	Dermatology	13:00:00.0000000	14:00:00.0000000	Tuesday
2	Sara	Dermatology	13:00:00.0000000	14:00:00.0000000	Tuesday	Saba	Dermatology	13:00:00.0000000	14:00:00.0000000	Tuesday

```
243   --QUERY 6
244   SELECT TOP 3 AP_DID,COUNT(AP_DID) AS 'No. Of Appointments'
245   FROM APPOINTMENT
246   GROUP BY AP_DID
247   ORDER BY COUNT(AP_DID) ASC
248
249
```

120 %

Results | Messages

	AP_DID	No. Of Appointments
1	1	1
2	4	1
3	3	1

```
250   --QUERY 7
251   SELECT TOP 1 AP_DID,COUNT(AP_DID) AS 'No. Of Appointments', AP_SPEC
252   FROM APPOINTMENT
253   WHERE AP_SPEC ='Anesthesiology'
254   GROUP BY AP_DID,AP_SPEC
255   ORDER BY COUNT(AP_DID) DESC
256
257
```

120 %

Results | Messages

	AP_DID	No. Of Appointments	AP_SPEC
1	3	1	Anesthesiology

SELF QUERIES

```
257
258   --NO. OF REQUESTS IN WAITING LIST
259   SELECT COUNT(*) AS 'No. of Waiting Requests'
260   FROM WAITING_LIST ;
261
```

120 %

Results | Messages

	No. of Waiting Requests
1	8

```sql
262    --NO. OF REQUESTS APPROVED AND MOVED TO APPOINTMENT
263  ⊟SELECT COUNT(*) AS 'No. of Appointments'
264    FROM APPOINTMENT ;
265
```

Results | **Messages**

	No. of Appointments
1	8

```sql
267    --NO. OF ASSIGNMENTS TAKEN BY DR.ABDULLAH
268  ⊟SELECT D_NAME,COUNT(*) AS 'No. Of Assignments'FROM ASSIGNMENT A
269    JOIN DOCTOR D ON A.ASS_DID = D.D_ID
270    WHERE D.D_NAME = 'Abdullah'
271    GROUP BY D_NAME
272
```

Results | **Messages**

	D_NAME	No. Of Assignments
1	Abdullah	2

```sql
273    --TIME ON WHICH REQUESTS WERE MADE BY PATIENT AYESHA
274  ⊟ SELECT P.P_NAME, R.RQ_S_TIME, R.RQ_E__TIME, R.RQ_SPEC
275    FROM PATIENT P JOIN REQUEST R
276    ON P.P_ID=R.RQ_PID
277    WHERE P.P_NAME='Ayesha'
278
```

Results | **Messages**

	P_NAME	RQ_S_TIME	RQ_E__TIME	RQ_SPEC
1	Ayesha	13:30:00.0000000	13:45:00.0000000	Neurology
2	Ayesha	11:00:00.0000000	12:00:00.0000000	Anesthesiology
3	Ayesha	17:00:00.0000000	18:00:00.0000000	Cosmetics
4	Ayesha	16:00:00.0000000	17:00:00.0000000	Dermatology

```sql
279    --DOCTOR THAT CAN SIT ON THE CLINICS ACC TO THEIR SPECIALITY
280    SELECT D.D_ID, D.D_NAME,D.d_SPECIALITY, C.C_ID,C.C_SPECIALITY
281    FROM DOCTOR D
282    JOIN CLINIC C ON D.D_SPECIALITY = C.C_SPECIALITY
283
```

120 %

Results | **Messages**

	D_ID	D_NAME	d_SPECIALITY	C_ID	C_SPECIALITY
1	1	Alina	Cardiologist	1	Cardiologist
2	2	Saba	Dermatology	2	Dermatology
3	3	Abdullah	Anesthesiology	4	Anesthesiology
4	4	Ayesha	Neurology	3	Neurology
5	5	Salwa	Surgery	5	Surgery
6	7	Asad	Urology	6	Urology
7	8	Taha	Cardiologist	1	Cardiologist
8	9	Sara	Dermatology	2	Dermatology

```sql
284    --DOCTORS WHO WORK ON CLINIC 1
285    SELECT D.D_NAME, A.ASS_CID FROM DOCTOR D
286    JOIN ASSIGNMENT A ON D.D_ID = A.ASS_DID
287    WHERE A.ASS_CID = 1
288
```

120 %

Results | **Messages**

	D_NAME	ASS_CID
1	Alina	1
2	Saba	1
3	Taha	1

```
296    --NAME OF PATIENTS IN WAITING LIST
297    SELECT P.P_NAME AS 'Patients in Waiting List'FROM PATIENT P
298    JOIN WAITING_LIST WL ON P.P_ID=WL.WL_PID
299
```

	Patients in Waiting List
1	Saba
2	Saba
3	Saba
4	Ayesha
5	Ayesha
6	Ayesha
7	Umair
8	Umair

```
300    --PATIENTS WHO HAVE APPOINTMENTS ON TUESDAY
301    SELECT P.P_NAME AS 'Patient Name', D.DAYS AS Day FROM APPOINTMENT A
302    JOIN DOCTOR D ON A.AP_DID=D.D_ID
303    JOIN PATIENT P ON A.AP_PID=P.P_ID
304    WHERE D.DAYS = 'Tuesday'
305
```

	Patient Name	Day
1	Saba	Tuesday
2	Ayesha	Tuesday
3	Ahmed	Tuesday
4	Karim	Tuesday

```
282    -- APPOINTMENTS ON FRIDAY
283    SELECT D.D_NAME AS DOCTOR ,P.P_NAME AS PATIENT, A.AP_S_TIME AS 'START TIME' ,A.AP_E_TIME AS 'END TIME',A.AP_SPEC AS SPECIALITY, D.DAYS AS DATE
284    FROM APPOINTMENT A JOIN DOCTOR D
285    ON A.AP_DID=D.D_ID
286    JOIN PATIENT P
287    ON A.AP_PID=P.P_ID
288    WHERE D.DAYS='Friday'
289
```

DOCTOR	PATIENT	START TIME	END TIME	SPECIALITY	DATE
Salwa	Ayesha	16:00:00.0000000	17:00:00.0000000	Dermatology	Friday

```sql
306      --SPECIALISATIONS AVAILABLE ON TUESDAY
307    SELECT distinct C.C_SPECIALITY AS Speciality, D.DAYS AS Date FROM ASSIGNMENT A
308      JOIN DOCTOR D ON A.ASS_DID=D.D_ID
309      JOIN CLINIC C ON A.ASS_CID=C_ID
310      WHERE D.DAYS = 'Tuesday'
311
```

120 %

Results | **Messages**

	Speciality	Date
1	Anesthesiology	Tuesday
2	Cardiologist	Tuesday

```sql
312      --NAMES OF ALL DOCTORS ASSIGNED TO CLINIC 1
313    SELECT D.D_NAME AS 'Doctors Working in Clinic 1'FROM DOCTOR D
314      JOIN ASSIGNMENT A ON D.D_ID=A.ASS_DID
315      JOIN CLINIC C ON A.ASS_CID=C.C_ID
316      WHERE C.C_ID = 1
317
```

120 %

Results | **Messages**

	Doctors Working in Clinic 1
1	Alina
2	Saba
3	Taha

```sql
319      --DOCTOR WITH CORRESPONDING NUMBER OF APPOINTMENTS
320    SELECT D.D_ID, D.D_NAME, D.D_SPECIALITY, COUNT(A.AP_DID) AS 'NO OF APPOINTMENTS'FROM DOCTOR D
321      JOIN APPOINTMENT A ON
322      A.AP_DID = D.D_ID
323      GROUP BY D.D_ID, D.D_NAME, D.D_SPECIALITY
324
```

120 %

Results | **Messages**

	D_ID	D_NAME	D_SPECIALITY	NO OF APPOINTMENTS
1	1	Alina	Cardiologist	1
2	2	Saba	Dermatology	4
3	3	Abdullah	Anesthesiology	1
4	4	Ayesha	Neurology	1
5	7	Asad	Urology	1

```sql
325    --DOCTOR WITH MAX NUMBER OF APPOINTMENTS
326    SELECT D.D_ID, D.D_NAME, D.D_SPECIALITY, COUNT(A.AP_DID) AS 'NO OF APPOINTMENTS'FROM DOCTOR D
327    JOIN APPOINTMENT A ON
328    A.AP_DID = D.D_ID
329    GROUP BY D.D_ID, D.D_NAME, D.D_SPECIALITY
330    HAVING COUNT(*) IN
331    (SELECT MAX(A.FREQ)
332    FROM (SELECT COUNT (*) AS FREQ FROM DOCTOR DD JOIN APPOINTMENT AA ON AA.AP_DID = DD.D_ID
333    GROUP BY DD.D_ID, DD.D_NAME, DD.D_SPECIALITY)A);
334
```

120 %

Results | Messages

	D_ID	D_NAME	D_SPECIALITY	NO OF APPOINTMENTS
1	2	Saba	Dermatology	4

```sql
335    --DOCTOR WITH MIN NUMBER OF APPOINTMENTS
336    SELECT D.D_ID, D.D_NAME, D.D_SPECIALITY, COUNT(A.AP_DID) AS 'NO OF APPOINTMENTS'FROM DOCTOR D
337    JOIN APPOINTMENT A ON
338    A.AP_DID = D.D_ID
339    GROUP BY D.D_ID, D.D_NAME, D.D_SPECIALITY
340    HAVING COUNT(*) IN
341    (SELECT MIN(A.FREQ)
342    FROM (SELECT COUNT (*) AS FREQ FROM DOCTOR DD JOIN APPOINTMENT AA ON AA.AP_DID = DD.D_ID
343    GROUP BY DD.D_ID, DD.D_NAME, DD.D_SPECIALITY)A);
```

120 %

Results | Messages

	D_ID	D_NAME	D_SPECIALITY	NO OF APPOINTMENTS
1	1	Alina	Cardiologist	1
2	3	Abdullah	Anesthesiology	1
3	4	Ayesha	Neurology	1
4	7	Asad	Urology	1

```sql
345    --PATIENTS WITH OVERALPPING APPOINTMENT AT SAME CLINIC
346    SELECT P1.P_ID, P1.P_NAME AS 'Patient Name',A1.AP_CID AS 'Clinic ID',
347    A1.AP_S_TIME AS 'Start Time', A1.AP_E_TIME AS 'End Time',P2.P_ID,P2.P_NAME AS 'Patient Name',
348    A2.AP_CID AS 'Clinic ID',A2.AP_S_TIME AS 'Start Time', A2.AP_E_TIME AS 'End Time'FROM PATIENT P1
349    JOIN PATIENT P2 ON P1.P_ID <> P2.P_ID
350    JOIN APPOINTMENT A1 ON P1.P_ID = A1.AP_PID
351    JOIN APPOINTMENT A2 ON A2.AP_PID = P2.P_ID
352    WHERE (A1.AP_CID = A2.AP_CID) AND
353    (A1.AP_S_TIME = A2.AP_S_TIME) AND (A1.AP_E_TIME = A2.AP_E_TIME) ;
```

120 %

Results | Messages

	P_ID	Patient Name	Clinic ID	Start Time	End Time	P_ID	Patient Name	Clinic ID	Start Time	End Time
1	1	Saba	1	13:00:00.0000000	14:00:00.0000000	3	Ahmed	1	13:00:00.0000000	14:00:00.0000000
2	1	Saba	1	13:00:00.0000000	14:00:00.0000000	5	Karim	1	13:00:00.0000000	14:00:00.0000000
3	3	Ahmed	1	13:00:00.0000000	14:00:00.0000000	1	Saba	1	13:00:00.0000000	14:00:00.0000000
4	3	Ahmed	1	13:00:00.0000000	14:00:00.0000000	5	Karim	1	13:00:00.0000000	14:00:00.0000000
5	5	Karim	1	13:00:00.0000000	14:00:00.0000000	1	Saba	1	13:00:00.0000000	14:00:00.0000000
6	5	Karim	1	13:00:00.0000000	14:00:00.0000000	3	Ahmed	1	13:00:00.0000000	14:00:00.0000000

TUPLES IN TABLES

1. Clinic

	C_ID	OPEN_HOURS	CLOSE_HOURS	C_SPECIALITY
1	1	12:00:00.0000000	15:00:00.0000000	Cardiologist
2	2	15:00:00.0000000	18:00:00.0000000	Dermatology
3	3	18:00:00.0000000	21:00:00.0000000	Neurology
4	4	21:00:00.0000000	23:00:00.0000000	Anesthesiology
5	5	13:00:00.0000000	14:00:00.0000000	Surgery
6	6	13:00:00.0000000	14:00:00.0000000	Urology

2. Doctor

	D_ID	D_NAME	D_SPECIALITY	DAYS
1	1	Alina	Cardiologist	Monday
2	2	Saba	Dermatology	Tuesday
3	3	Abdullah	Anesthesiology	Wednesday
4	4	Ayesha	Neurology	Thursday
5	5	Salwa	Surgery	Friday
6	6	Ramsha	Pediatrics	Saturday
7	7	Asad	Urology	Sunday
8	8	Taha	Cardiologist	Tuesday
9	9	Sara	Dermatology	Tuesday

3. Patient

	P_ID	P_NAME
1	1	Saba
2	2	Ayesha
3	3	Ahmed
4	4	Umair
5	5	Karim
6	6	Amjad

4. Assignment

	ASS_S_TIME	ASS_E_TIME	ASS_CID	ASS_DID
1	13:00:00.0000000	14:00:00.0000000	1	1
2	13:00:00.0000000	14:00:00.0000000	1	2
3	13:00:00.0000000	14:00:00.0000000	1	8
4	16:00:00.0000000	17:00:00.0000000	2	5
5	19:00:00.0000000	20:00:00.0000000	3	4
6	21:30:00.0000000	22:30:00.0000000	4	3
7	21:30:00.0000000	22:00:00.0000000	4	8
8	13:00:00.0000000	14:00:00.0000000	5	3
9	13:00:00.0000000	14:00:00.0000000	6	5

5. Appointment

	AP_S_TIME	AP_E_TIME	AP_PID	AP_DID	AP_CID	AP_SPEC
1	13:00:00.0000000	14:00:00.0000000	1	2	1	Cardiologist
2	13:30:00.0000000	13:45:00.0000000	2	2	1	Neurology
3	13:00:00.0000000	14:00:00.0000000	3	2	1	Pediatrics
4	19:00:00.0000000	20:00:00.0000000	3	4	3	Neurology
5	13:00:00.0000000	14:00:00.0000000	5	1	2	Cardiologist
6	13:00:00.0000000	14:00:00.0000000	5	2	1	Cardiologist
7	13:45:00.0000000	14:00:00.0000000	5	3	1	Anesthesiology
8	21:45:00.0000000	22:15:00.0000000	5	7	1	Urology

6. Waiting_List

	WL_S_TIME	WL_E_TIME	WL_PID	WL_DID	WL_CID	WL_SPEC
1	11:00:00.0000000	12:00:00.0000000	1	2	2	Cardiologist
2	21:45:00.0000000	22:15:00.0000000	1	2	4	Anesthesiology
3	13:00:00.0000000	14:00:00.0000000	1	8	1	Pediatrics
4	11:00:00.0000000	12:00:00.0000000	2	4	2	Anesthesiology
5	17:00:00.0000000	18:00:00.0000000	2	4	3	Cosmetics
6	16:00:00.0000000	17:00:00.0000000	2	5	2	Dermatology
7	21:45:00.0000000	22:15:00.0000000	4	3	4	Anesthesiology
8	01:00:00.0000000	08:00:00.0000000	4	4	4	Pediatrics

REALTIONAL ALGEBRA QUERIES

Query 1

$$\Pi_{AP\_CID, P\_Name} \left(\sigma_{AP\_CID = 1} \left(Appointment \bowtie Patient \right) \right)$$

Query 2

$$\Pi_{AP\_SPEC, P\_Name} \left(\sigma_{AP\_SPEC = \text{'cardiology'}} \left(Appointment \bowtie Patient \right) \right)$$

Query 4

$$\left(\sigma_{(Ass\_S\_TIME = \text{'13:00:00'}) \wedge (Ass\_E\_TIME : \text{'14:00:00'})} \right)$$

Query 5

$D_1 \leftarrow Doctor$

$D_2 \leftarrow Doctor$

$A_1 \leftarrow Assignment$

$A_2 \leftarrow Assignment$

$$\sigma_{\substack{D_1.Days = D_2.Days \\ \wedge \\ D_1.D\_ID \,!= D_2.D\_ID \\ \wedge \\ A_1.Ass\_CID = A_2.Ass\_CID \\ \wedge \\ A_1.Ass\_S\_TIME = A_2.Ass\_S\_TIME \\ \wedge \\ A_1.ASS\_E\_TIME = A_2.Ass\_E\_TIME}} \left(\left(\left(D_1 \bowtie D_2 \right) \bowtie A_1 \right) \bowtie A_2 \right)$$

Query 6

$$_{Ap\text{-}DID}\ \mathcal{G}_{min}\ \left(_{Ap\text{-}DID}\ \mathcal{G}_{count(Ap\text{-}DID)}\ (Appointment)\right)$$

Query 7

$$count \leftarrow \left(_{Ap\text{-}DID}\ \mathcal{G}_{count(Ap\text{-}DID)}\ (Appointment)\right)$$

$$count\_spec \leftarrow \sigma_{Ap\text{-}spec = 'cardiology'}\ (count)$$

$$_{Ap\text{-}DID}\ \mathcal{G}_{max(count\text{-}spec)}$$

Self Made Queries

$\Rightarrow$ No. of assignments by doctor Abdullah

$$A \leftarrow \sigma_{D\text{-}Name = 'Abdullah'}\ (Assignment \bowtie Doctor)$$

$$count \leftarrow (_{D\text{-}Name}\ \mathcal{G}_{count(A)})$$

$$\Pi_{D\text{-}Name,\ count(A)}$$

$\Rightarrow$ Time on which request made by patient Ayesha

$$PR\text{-}Join \leftarrow (Patient \bowtie Request)$$

$$Name \leftarrow \sigma_{P\text{-}Name = 'Ayesha'}\ (PR\text{-}Join)$$

$$\Pi_{P\text{-}Name,\ RQ\text{-}S\text{-}Time,\ Rq\text{-}E\text{-}time,\ RQ\text{-}SPEC}\ (Name)$$

$\Rightarrow$ Doctor that sit on Clinic according to Speciality

DC-Join $\leftarrow$ (Doctor $\bowtie$ Clinic)

$$\Pi_{D-NO, D-Name, D-Spec, C-ID, C-spec} (DC-Join)$$

→ Doctors who work on clinic 1

$$DA-JOIN \leftarrow Doctor \bowtie Assignment$$
$$A \leftarrow \sigma_{ASS\_CID=1} (DA-JOIN)$$
$$\pi_{6\_Name, ASS\_CID=1} (A)$$

→ Appointments on Friday

$$ADP-JOIN \leftarrow (Appoinment \bowtie Doctor) \bowtie Patient$$
$$AD \leftarrow \sigma_{DAY='Friday'} (ADP-JOIN)$$
$$\pi_{D-Name, P-Name, START-TIME, END-TIME, SPECIALITY} (AD)$$

→ Name of Patients in waiting List

$$P\_WL-JOIN \leftarrow Patient \bowtie Waiting-List$$
$$RESULT \leftarrow \pi_{P-Name} (P-WL-JOIN)$$

→ Patients who have appointments on Tuesday

ADP_JOIN ← ((APPOINTMENT ⊠ Doctor) ⊠ Patient)

$P \leftarrow \sigma_{DAYS = 'Tuesday'} (APP\_JOIN)$

$\pi_{P\_Name, DAYS} (P)$

→ Specialization available on Tuesday.

ADC_JOIN ← ((ASSIGNMENT ⊠ Doctor) ⊠ Clinic)

$A \leftarrow \sigma_{C\_ID = 1} (ADC\_JOIN)$

Result. ← $\pi_{speciality, Days} (A)$

→ Name of all the doctors assigned to clinic 1

ADC_JOIN ← ((Doctor ⊠ Assignment) ⊠ Clinic)

$A \leftarrow \sigma_{C\_ID = 1} (ADC\_JOIN)$

Result ← $\pi_{D\_Name} (A)$

Day / Date → No. of requests in waiting lists.

$$\mathcal{G}_{count(*)} (waiting-List)$$

→ No. of requests approved and moved to appointment

$$\mathcal{G}_{count(*)} (Appointment)$$

→ Doctor with corresponding number of Appointment

DA-JOIN ← (Doctor $\bowtie$ Appointment)

$$\Pi \left(D\_ID, D\_Name, D\_SPEC \, \mathcal{G}_{count(AP\_DID)} \left(DA\_JOIN \right) \right)$$

→ Doctor with max no. of appointments.

DA-JOIN ← APPOINTMENT $\bowtie$ Doctor

$$Count \leftarrow {}_{D\_ID, D\_Name, D\_SPEC} \, \mathcal{G}_{count(AP\_PID)} (DA\_JOIN)$$

$$RESULT \leftarrow {}_{D\_ID, D\_Name, D\_SPEC} \, \mathcal{G}_{max(count)}$$

→ Doctor with minimum no. of appointments.

DA-JOIN ← Appointment $\bowtie$ Doctor

$$COUNT \leftarrow {}_{D\_ID, D\_Name, D\_SPEC} \, \mathcal{G}_{count(AP\_DID)} (DA-JOIN)$$

$$RESULT \leftarrow {}_{D\_ID, D\_Name, D\_SPEC} \, \mathcal{G}_{max(COUNT)}$$

— Sunny

→ Patients with overlapping appointments

$P1 \leftarrow$ Patient

$P2 \leftarrow$ Patient

$A1 \leftarrow$ Appointment

$A2 \leftarrow$ Appointment

$P1P2 \leftarrow$

$$\sigma_{\substack{P1 \cdot ID <> \\ P2 \cdot ID}} (P1 \times P2)$$

$$P1P2A1 \leftarrow \sigma_{\substack{P1 \cdot ID = \\ A1 \cdot AP\_PID}} (P1P2 \times A1)$$

$$P1P2A1A2 \leftarrow \sigma_{\substack{P2 \cdot ID \\ = A2 \cdot AP\_PID}} (P1P2A1 \times A2)$$

$$\sigma_{\substack{(A1 \cdot CID = A2 \cdot CID) \wedge (A1 \cdot S\_TIME = A2 \cdot S\_TIME) \wedge \\ (A1 \cdot E\_TIME = A2 \cdot E\_TIME)}} (P1P2A1A2)$$