FACULTY OF COMPUTING & INFORMATION TECHNOLOGY
KING ABDULAZIZ UNIVERSITY

كلية الحاسبات وتقنية المعلومات
جامعة الملك عبدالعزيز

CPIT 240- Project

(Hospital Database)

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Contents

Description

The project involves creating a database system for a hospital. The database will store information about the staff, patients, medicines, clinics, and invoices. This will help the hospital store the history of patients and provide the best possible services at the best optimal time.

Scenario and requirements

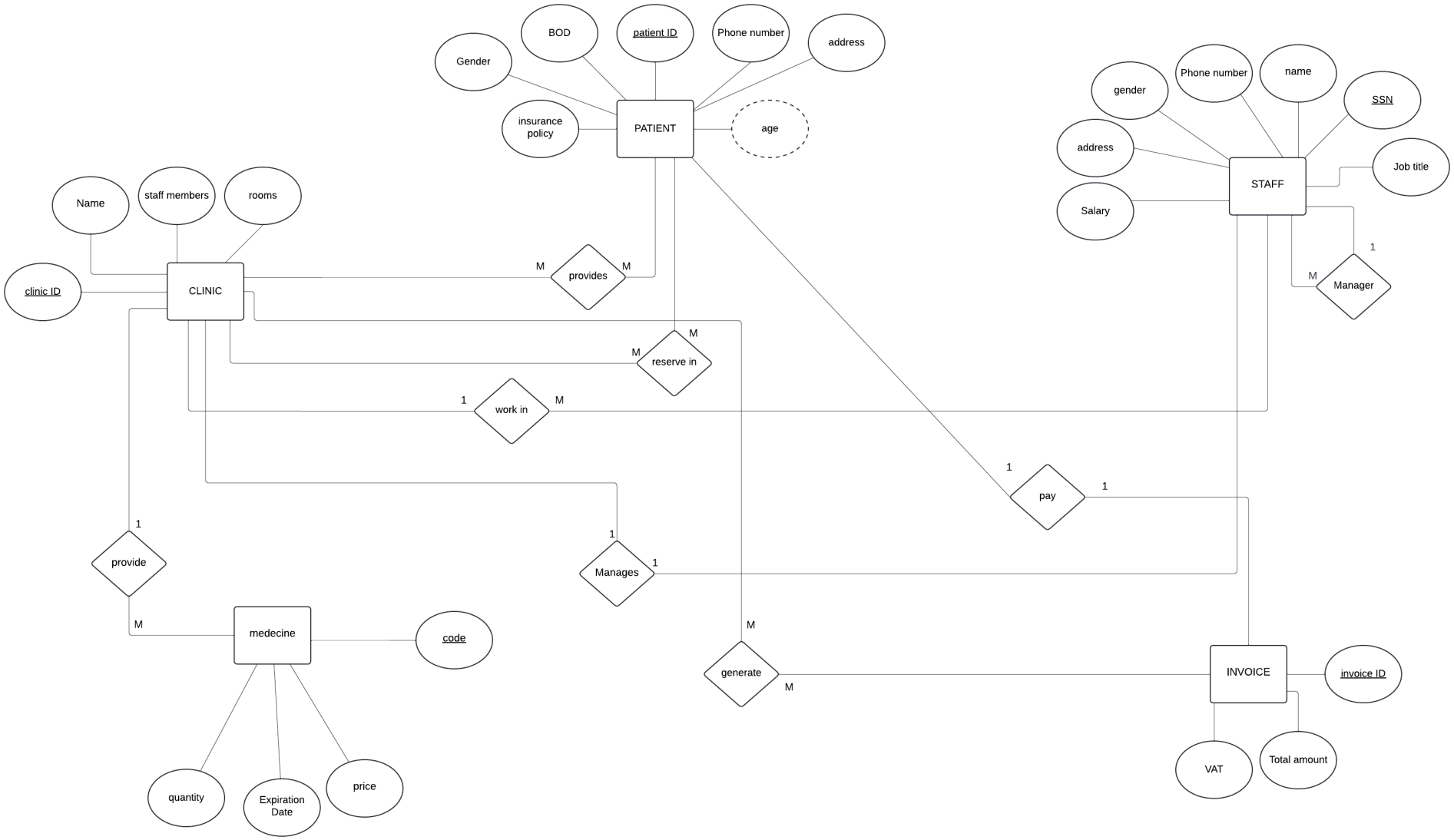
You have been hired to create a DB system for a local hospital.

The DB should make the PATIENT **reserve in** CLINIC and Each patient should have a unique ID, Name, Date of Birth (BOD), Phone number, insurance policy, Gender, age, and address. Each CLINIC should have a unique clinic Number, Name, staff members, and rooms and the CLINIC must be **managed by** only one of the STAFF members. Each STAFF member should have a Job title, Social Security Number (SSN), Name, Phone number, gender, address, and Salary. and every STAFF has a supervisor. The STAFF members will **work in** specific CLINIC. Every MEDICINE should have a unique code, Name, Expiration Date (E-date), and Price, and quantity.

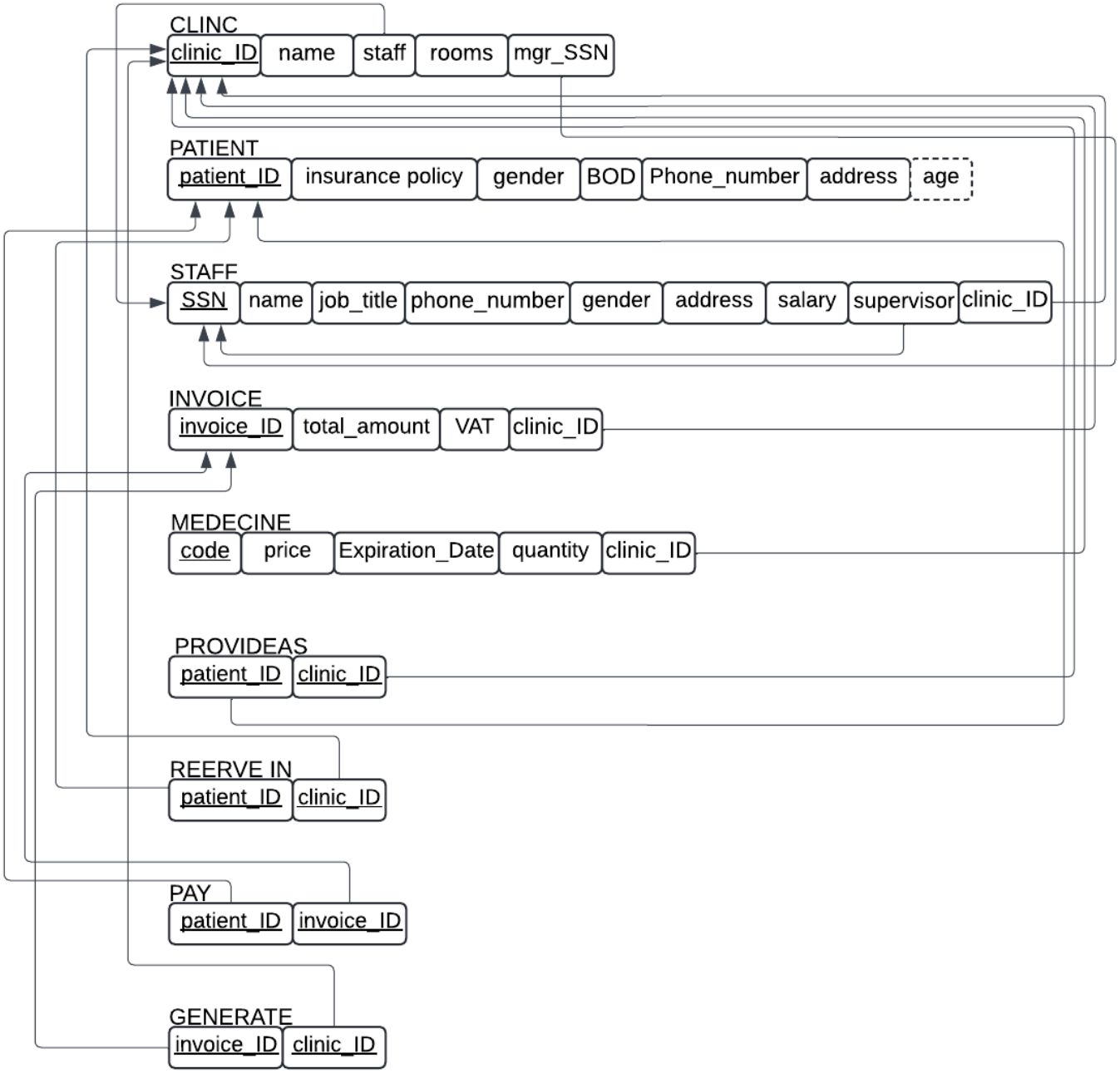
The following are the entities of the database:

- Patient
- Clinic
- Medicine
- Invoice
- Staff

ER Diagram:


BOD
patient ID
Phone number
address
Gender
insurance policy
PATIENT
age
gender
Phone number
name
SSN
address
Job title
STAFF
Salary
Name
staff members
rooms
clinic ID
CLINIC
M
provides
M
1
Manager
M
M
reserve in
M
1
work in
M
1
pay
1
1
provide
1
Manages
1
M
medecine
code
M
generate
M
INVOICE
invoice ID
VAT
Total amount
quantity
Expiration Date
price

Schema:


CLINC
clinic_ID
name
staff
rooms
mgr_SSN
PATIENT
patient_ID
insurance policy
gender
BOD
Phone_number
address
age
STAFF
SSN
name
job_title
phone_number
gender
address
salary
supervisor
clinic_ID
INVOICE
invoice_ID
total_amount
VAT
clinic_ID
MEDECINE
code
price
Expiration_Date
quantity
clinic_ID
PROVIDEAS
patient_ID
clinic_ID
REERVE IN
patient_ID
clinic_ID
PAY
patient_ID
invoice_ID
GENERATE
invoice_ID
clinic_ID

Explanation of the ER Diagram:

CLINIC

- Attributes:
- clinic_ID: A unique identifier for each clinic.
- Name: The name of the clinic.
- staff members: The staff members working in the clinic.
- rooms: The number of rooms available in the clinic.
- Description: This entity represents the clinics within the healthcare system. Each clinic can have multiple staff members and rooms, and it provides services to patients and manages invoices.

PATIENT

-Attributes:
- patient_ID: A unique identifier for each patient.
- Gender: The gender of the patient.
- BOD (Date of Birth): The birthdate of the patient.
- Phone number: The contact number of the patient.
- Address: The residential address of the patient.
- Insurance policy: Details of the patient's insurance policy.
- Age: The age of the patient
- Description: This entity represents the patients who receive services from the clinics. Patients have various personal details recorded, and they generate invoices for the services they use.

STAFF

- Attributes:
- SSN: The Social Security Number, acting as a unique identifier for each staff member.
- Gender: The gender of the staff member.
- Phone number: The contact number of the staff member.
- name: The name of the staff member.
- Address: The residential address of the staff member.
- Salary: The salary of the staff member.

- Job title: The job title of the staff member, indicating their role within the clinic.
- Description: This entity represents the employees working in the clinics. Staff members have personal details, job titles, and salaries recorded. They can also manage other staff members and handle invoice payments.

MEDICINE

- Attributes:
- code: A unique identifier for each type of medicine.
- quantity: The quantity of the medicine available.
- Expiration Date: The expiration date of the medicine.
- price: The price of the medicine.
- Description: This entity represents the medicines provided by the clinic. Each medicine has specific details such as quantity, expiration date, and price.

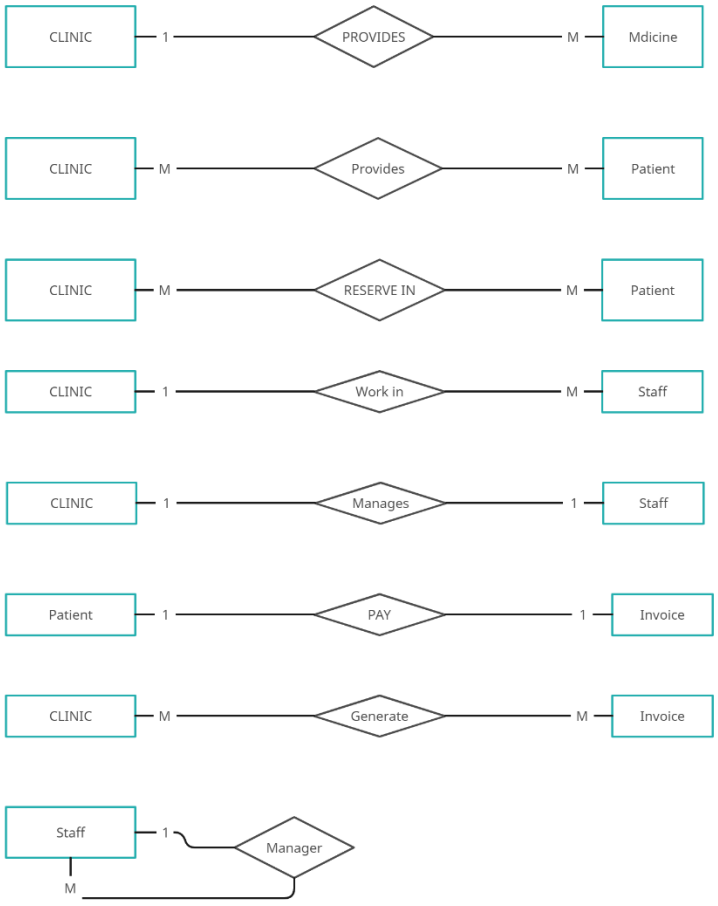
INVOICE

- Attributes:
- invoice_ID: A unique identifier for each invoice.
- VAT: The Value Added Tax applied to the invoice.
- Total amount: The total amount to be paid as per the invoice.
- Description: This entity represents the invoices generated for the services provided to patients. Invoices include details like VAT and the total amount payable.

Description of relations between entities:

- The CLINIC **provides** MEDICINE for the PATIENTs.
- The CLINIC will **generate** an invoice for the PATIENT.
- The patient will reserve in a CLINIC.
- The patient will **pay** the invoice. It should have a unique invoice number, Total amount, and VAT total after VAT.
- The staff members will work in a CLINIC.
- Each CLINIC will be managed by a staff member
- The CLINIC will provide services for the patients.

Mapping relationships



Explanation of Relational Schema:

CLINIC

- Attributes: `clinic_ID` (PK), `name`, `staff`, `rooms`, `mgr_SSN` (FK)
- Description: Stores information about clinics, including their ID, name, staff count, room count, and manager's SSN. We added the managers SSN to assign a manager from the staff to each clinic.

PATIENT

- Attributes: `patient_ID` (PK), `insurance_policy`, `gender`, `BOD`, `Phone_number`, `address`, `age` (derived)
- Description: Holds patient details such as ID, insurance, gender, birthdate, phone number, address, and calculated age.

STAFF

- Attributes: `SSN` (PK), `name`, `job_title`, `phone_number`, `gender`, `address`, `salary`, `supervisor` (FK), `clinic_ID` (FK)
- Description: Contains staff member information including SSN, name, job title, contact details, salary, supervisor's SSN, and clinic ID. We added the clinic_ID to assign each staff member to a clinic.

INVOICE

- Attributes: `invoice_ID` (PK), `total_amount`, `VAT`, `clinic_ID` (FK)
- Description: Records invoice data, such as invoice ID, total amount, VAT, and associated clinic ID. We added the clinic_ID to assign every invoice to a certain clinic.

MEDICINE

- Attributes: `code` (PK), `price`, `Expiration_Date`, `quantity`, `clinic_ID` (FK)
- Description: Tracks medicine inventory with attributes like code, price, expiration date, quantity, and clinic ID. We added the clinic_ID to distribute the medicine for the right clinics.

PROVIDES

- Attributes: `patient_ID` (FK), `clinic_ID` (FK)
- Description: Manages which patients receive services from which clinics.

RESERVE IN

- Attributes: `patient_ID` (FK), `clinic_ID` (FK)
- Description: Handles patient reservations in clinics.

PAY

- Attributes: `patient_ID` (FK), `invoice_ID` (FK)
- Description: Links payments made by patients to invoices.

GENERATE

- Attributes: `invoice_ID` (FK), `clinic_ID` (FK)
- Description: Associates generated invoices with clinics.

Implantation

Creation tables

```
create table clinic (
    clinic_ID number (10) , clinic_name varchar2 (20) ,
    manager number(10) ,  room number (10),
    CONSTRAINT C_PK primary key (clinic_ID) );
```

```
create table patient (
patient_ID number (10) , insurance_policy number (10) , gendar varchar2 (5)
    , BOT date , phone number (10) , address varchar2 (25) ,
    CONSTRAINT P_PK primary key (patient_ID) );
```

```
create table staff (
    SSN number (10) , staff_name varchar2 (10) , job_title varchar2 (25) , phone_number number (10)
    , gendar varchar2 (5) , s_address varchar2 (25) , salary number (10) , supervisor number (10)
    , s_clinic_id number (10)
    , CONSTRAINT S_PK primary key (SSN)
    , CONSTRAINT S_FK
    foreign key (s_clinic_id) REFERENCES clinic (clinic_ID) ,
    foreign key (supervisor) REFERENCES staff (SSN) );
```

```
create table invoice (
    invoice_ID number(10) , total_amount number (10) , VAT number (10) , I_clinic_ID number (10)
    , CONSTRAINT I_PK primary key (invoice_ID)
    , CONSTRAINT I_FK foreign key (I_clinic_ID) REFERENCES clinic (clinic_ID));
```

```
create table medecine (
code number (10) , price number (10) , expiration_date date , quantity number (10) ,m_clinic_id number (10)
, CONSTRAINT M_PK PRIMARY KEY (code)
 , CONSTRAINT M_FK FOREIGN KEY (M_clinic_ID) REFERENCES clinic (clinic_ID));
```

```
create table provideing (
pr_patient_ID number (10) , pr_clinic_ID number (10) ,
CONSTRAINT Pr_PK PRIMARY KEY (pr_patient_ID,pr_clinic_ID)  , CONSTRAINT Pr_FK
FOREIGN KEY (pr_clinic_ID) REFERENCES clinic (clinic_ID) , FOREIGN KEY (pr_patient_ID) REFERENCES patient (patient_ID));
```


```
create table provideing (
pr_patient_ID number (10) , pr_clinic_ID number (10) ,
CONSTRAINT Pr_PK PRIMARY KEY (pr_patient_ID,pr_clinic_ID)  , CONSTRAINT Pr_FK
FOREIGN KEY (pr_clinic_ID) REFERENCES clinic (clinic_ID) , FOREIGN KEY (pr_patient_ID) REFERENCES patient (patient_ID));
```

```
create table reserve_in (
r_patient_ID number (10) , r_clinic_ID number (10)
    , CONSTRAINT r_PK PRIMARY KEY (r_patient_ID,r_clinic_ID)
    , CONSTRAINT r_FK
    FOREIGN KEY (r_clinic_ID) REFERENCES clinic (clinic_ID) ,
    FOREIGN KEY (r_patient_ID) REFERENCES patient (patient_ID));
```

```
create table pay (
    pa_patient_ID number (10) , pa_invoice_ID number (10) ,
CONSTRAINT Pa_PK PRIMARY KEY (pa_patient_ID,pa_invoice_ID),
CONSTRAINT Pa_FK
FOREIGN KEY (pa_invoice_ID) REFERENCES invoice (invoice_ID) ,
FOREIGN KEY (pa_patient_ID) REFERENCES patient (patient_ID));
```

```
create table generate (
g_clinic_ID number (10) , g_invoice_ID number (10)
    , CONSTRAINT g_PK PRIMARY KEY (g_clinic_ID,g_invoice_ID)
    , CONSTRAINT g_FK
    FOREIGN KEY (g_invoice_ID) REFERENCES invoice (invoice_ID) ,
    FOREIGN KEY (g_clinic_ID) REFERENCES clinic (clinic_ID));
```

Modification tables

```
alter table clinic

add CONSTRAINT C_FK FOREIGN KEY (manager) REFERENCES
staff (SSN);
```

Insert into Tables

```
insert into clinic (clinic_ID , clinic_name , room)
values (1001 , 'Dental' , 5);
insert into clinic (clinic_ID , clinic_name , room)
values (1002 , 'Hearing' , 6);
insert into clinic (clinic_ID , clinic_name , room)
values (1003 , 'Rural' , 9);
insert into clinic (clinic_ID , clinic_name , room)
values (1004 , 'Health' , 3);
```

```
insert into staff (SSN , staff_name , job_title , phone_number , gender,
s_address , salary , s_clinic_id )
values (8120 , 'Wassem' , 'Manger' , 0500000 , 'M' , 'Aljama' , 30000 , 1001);

insert into staff (SSN , staff_name , job_title , phone_number , gender,
s_address , salary , s_clinic_id )
values (8911 , 'Fatima' , 'Manger' , 0511111 , 'F' , 'Alnassim' , 30000 , 1002);

insert into staff (SSN , staff_name , job_title , phone_number , gender,
s_address , salary , s_clinic_id )
values (8820 , 'Abdullah' , 'Manger' , 0522222 , 'M' , 'Alrwabi' , 30000 , 1003);

insert into staff (SSN , staff_name , job_title , phone_number , gender,
s_address , salary , s_clinic_id )
values (8254 , 'Khaled' , 'Manger' , 05647282 , 'M' , 'Aljama' , 30000 , 1004);
```

insert into staff

```
insert into staff (SSN, staff_name, job_title, phone_number, gender, s_address, salary, s_clinic_id, supervisor)
values (8649, 'Ahmed', 'Doctor', 053333, 'M', 'Aljama', 19000, 1001, 8120);

insert into staff (SSN, staff_name, job_title, phone_number, gender, s_address, salary, s_clinic_id, supervisor)
values (8649, 'Ahmed', 'Doctor', 053333, 'M', 'Aljama', 19000, 1001, 8120);

insert into staff (SSN, staff_name, job_title, phone_number, gender, s_address, salary, s_clinic_id, supervisor)
values (8409, 'Salman', 'Doctor', 054444, 'M', 'Alazizia', 25000, 1002, 8911);

insert into staff (SSN, staff_name, job_title, phone_number, gender, s_address, salary, s_clinic_id, supervisor)
values (8321, 'Meshal', 'Doctor', 055555, 'M', 'Alrwabi', 20000, 1003, 8820);
```

```
insert into staff (SSN, staff_name, job_title, phone_number, gender, s_address, salary, s_clinic_id, supervisor)
values (8456, 'Manal', 'Nurce', 056666, 'F', 'Aljama', 15000, 1002, 8409);

insert into staff (SSN, staff_name, job_title, phone_number, gender, s_address, salary, s_clinic_id, supervisor)
values (8954, 'Laila', 'Doctor', 0592874, 'F', 'Alrwabi', 20000, 1004, 8254);

insert into staff (SSN, staff_name, job_title, phone_number, gender, s_address, salary, s_clinic_id, supervisor)
values (8977, 'Huda', 'Nurse', 0589372, 'F', 'Alrwabi', 20000, 1004, 8954);
```

update manager

```
update clinic set MANAGER = 8120
    where CLINIC_ID = 1001;
update clinic set MANAGER = 8911
    where CLINIC_ID = 1002;
update clinic set MANAGER = 8820
    where CLINIC_ID = 1003;
update clinic set MANAGER = 8254
    where CLINIC_ID = 1004;
```

insert into medicine

```
insert into medecine (code , price , expiration_date , quantity , m_clinic_id )
values (5832 , 1190 , '1-JAN-2027', 7 , 1003 );

insert into medecine (code , price , expiration_date , quantity , m_clinic_id )
values (5932 , 45 , '1-JAN-2028', 8 , 1001 );

insert into medecine (code , price , expiration_date , quantity , m_clinic_id )
values (5427 , 120 , '1-JAN-2026', 4 , 1002 );

insert into medecine (code , price , expiration_date , quantity , m_clinic_id )
values (5491 , 230 , '1-JAN-2025', 3 , 1003 );
```

Insert into patient

```
insert into patient (patient_ID , insurance_policy , gender, BOD , phone , address )
values (2001 , 6812 , 'M'  , '18-FEB-2004' , 055878743 , 'alfaiha' ) ;

insert into patient (patient_ID , insurance_policy , gender, BOD, phone , address )
values (2002 , 4321 , 'M'  , '4-SEP-2001' , 0565375838 , 'alsafa' ) ;

insert into patient (patient_ID , insurance_policy , gender, BOD, phone , address )
values (2003 , 4789 , 'F'  , '26-JUL-1985' , 0569568974 , 'alsalama' ) ;

insert into patient (patient_ID , insurance_policy , gender, BOD, phone , address )
values (2004 , 3216 , 'M'  , '4-NOV-1977' , 05463753764 , 'alnaseem' ) ;

insert into patient (patient_ID , insurance_policy , gender , BOD, phone , address )
values (2005 , 3298 , 'M'  , '4-NOV-1977' , 05463753764 , 'alnaseem' ) ;

insert into patient (patient_ID , insurance_policy , gender, BOD, phone , address )
values (2006 , 4378 , 'M'  , '4-NOV-1977' , 05463753764 , 'alnaseem' ) ;
```

```
insert into patient (patient_ID , insurance_policy , gendar , BOD, phone , address )
values (2007 , 6284 , 'M'  , '4-NOV-1977' , 05463753764 , 'alnaseem' ) ;

insert into patient (patient_ID , insurance_policy , gendar , BOD, phone , address )
values (2008 , 9824 , 'M'  , '4-NOV-1977' , 05463753764 , 'alnaseem' ) ;

insert into patient (patient_ID , insurance_policy , gendar , BOD, phone , address )
values (2009 , 1364 , 'M'  , '4-NOV-1977' , 05463753764 , 'alnaseem' ) ;

insert into patient (patient_ID , insurance_policy , gendar , BOD, phone , address )
values (2010 , 4828 , 'M'  , '4-NOV-1977' , 05463753764 , 'alnaseem' ) ;
```

Insert into invoice

```
insert into invoice ( invoice_ID , total_amount , VAT , I_clinic_ID )
values (7245 , 1190 , 178.5 , 1003) ;

insert into invoice ( invoice_ID , total_amount , VAT , I_clinic_ID )
values (7329 , 45 , 6.75 , 1001) ;

insert into invoice ( invoice_ID , total_amount , VAT , I_clinic_ID )
values (7639 , 120 , 18 , 1002) ;

insert into invoice ( invoice_ID , total_amount , VAT , I_clinic_ID )
values (7283 , 230 , 34.5 , 1003) ;
insert into invoice ( invoice_ID , total_amount , VAT , I_clinic_ID )
values (8921 , 1183 , 230 , 1001) ;

insert into invoice ( invoice_ID , total_amount , VAT , I_clinic_ID )
values (4379 , 1983 , 178 , 1004) ;

insert into invoice ( invoice_ID , total_amount , VAT , I_clinic_ID )
values (9821 , 50 , 7 , 1002) ;
```

```
insert into invoice ( invoice_ID , total_amount , VAT , I_clinic_ID )
values (8745 , 270 , 50 , 1003) ;

insert into invoice ( invoice_ID , total_amount , VAT , I_clinic_ID )
values (9233 , 270 , 50 , 1004) ;

insert into invoice ( invoice_ID , total_amount , VAT , I_clinic_ID )
values (7825 , 270 , 50 , 1002) ;
```

Insert into providing

```
insert into provideing (pr_patient_ID , pr_clinic_ID )
values (2001,1001);

insert into provideing (pr_patient_ID , pr_clinic_ID )
values (2002,1002);

insert into provideing (pr_patient_ID , pr_clinic_ID )
values (2003,1003);

insert into provideing (pr_patient_ID , pr_clinic_ID )
values (2004,1003);

insert into provideing (pr_patient_ID , pr_clinic_ID )
values (2005,1001);

insert into provideing (pr_patient_ID , pr_clinic_ID )
values (2006,1004);

insert into provideing (pr_patient_ID , pr_clinic_ID )
values (2007,1002);
```

```
insert into provideing (pr_patient_ID , pr_clinic_ID )
values (2008,1003);

insert into provideing (pr_patient_ID , pr_clinic_ID )
values (2009,1004);

insert into provideing (pr_patient_ID , pr_clinic_ID )
values (2010,1002);
```

Insert into reserve in

```
insert into reserve_in (r_patient_ID , r_clinic_ID )
values (2001,1001);

insert into reserve_in (r_patient_ID , r_clinic_ID )
values (2002,1002);

insert into reserve_in (r_patient_ID , r_clinic_ID )
values (2003,1003);

insert into reserve_in (r_patient_ID , r_clinic_ID )
values (2004,1003);

insert into reserve_in (r_patient_ID , r_clinic_ID )
values (2005,1001);

insert into reserve_in (r_patient_ID , r_clinic_ID )
values (2006,1004);

insert into reserve_in (r_patient_ID , r_clinic_ID )
values (2007,1002);
```

```
insert into reserve_in (r_patient_ID , r_clinic_ID )
values (2008,1003);

insert into reserve_in (r_patient_ID , r_clinic_ID )
values (2009,1004);

insert into reserve_in (r_patient_ID , r_clinic_ID )
values (2010,1002);
```

Insert into pay

```
insert into pay ( pa_patient_ID , pa_invoice_ID )
    values (2001,7329);
insert into pay ( pa_patient_ID , pa_invoice_ID )
    values (2002,7639);
insert into pay ( pa_patient_ID , pa_invoice_ID )
    values (2003,7245);
insert into pay ( pa_patient_ID , pa_invoice_ID )
    values (2004,7283);
insert into pay ( pa_patient_ID , pa_invoice_ID )
    values (2005,8921);
insert into pay ( pa_patient_ID , pa_invoice_ID )
    values (2006,4379);
insert into pay ( pa_patient_ID , pa_invoice_ID )
    values (2007,9821);
insert into pay ( pa_patient_ID , pa_invoice_ID )
    values (2008,8745);
insert into pay ( pa_patient_ID , pa_invoice_ID )
    values (2009,9233);
insert into pay ( pa_patient_ID , pa_invoice_ID )
    values (2010,7825);
```

Insert into generate

```
insert into generate ( g_invoice_ID , g_clinic_ID  )
    values (7329,1001);
insert into generate ( g_invoice_ID , g_clinic_ID  )
    values (7639,1002);
insert into generate ( g_invoice_ID , g_clinic_ID  )
    values (7245,1003);
insert into generate ( g_invoice_ID , g_clinic_ID  )
    values (7283,1003);
insert into generate ( g_invoice_ID , g_clinic_ID  )
    values (8921,1001);
insert into generate ( g_invoice_ID , g_clinic_ID  )
    values (4379,1004);
insert into generate ( g_invoice_ID , g_clinic_ID  )
    values (9821,1002);
insert into generate ( g_invoice_ID , g_clinic_ID  )
    values (8745,1003);
insert into generate ( g_invoice_ID , g_clinic_ID  )
    values (9233,1004);
insert into generate ( g_invoice_ID , g_clinic_ID  )
    values (7825,1002);
```

Queries

1.Select all patients provided services by a specific clinic:

```
SELECT patient.*
FROM provideing, patient
WHERE provideing.pr_patient_ID = patient.patient_ID
and provideing.pr_clinic_ID = 1001;
```

$\pi_{\text{patient\_ID,insurance\_policy, gender, BOD, s\_address, salary, supervisor, s\_clinic\_id}}(\sigma_{\text{pr\_clinic\_ID=1001}}(\textit{provideing} \bowtie_{\text{pr\_patient\_ID=patient\_ID}} \textit{patient}))$

PATIENT_ID	INSURANCE_POLICY	GENDER	BOD	PHONE	ADDRESS
2001	6812	M	18-FEB-04	55878743	alfaiha

2. List all clinics along with the count of staff members working in each clinic:

```
SELECT clinic.clinic_ID, clinic.clinic_name, COUNT(staff.SSN) AS
staff_count
FROM clinic, staff
WHERE clinic.clinic_ID = staff.s_clinic_id
GROUP BY clinic.clinic_ID, clinic.clinic_name;
```

$\pi_{\text{clinic.clinic\_ID, clinic.clinic\_name,}} \mathcal{F}_{\text{COUNT}}(\text{staff.SSN})(\sigma_{\text{clinic.clinic\_ID = staff.s\_clinic\_id}} (\text{clinic} \times \text{staff}))$

CLINIC_ID	CLINIC_NAME	STAFF_COUNT
1004	Health	3
1001	Dental	2
1002	Hearing	3
1003	Rural	2

3.Get details of all invoices paid by a specific patient:

```
SELECT invoice.* FROM pay
JOIN invoice ON pay.pa_invoice_ID = invoice.invoice_ID
WHERE pay.pa_patient_ID = 2001;
```

$\pi_{\textit{invoice\_ID, total\_amount, VAT, I\_clinic\_ID}}(\sigma_{\text{pa\_patient\_ID = 2001}} (\text{pay} \bowtie_{\text{pa\_invoice\_ID = invoice\_ID}} \text{invoice}))$

INVOICE_ID	TOTAL_AMOUNT	VAT	I_CLINIC_ID
7329	45	7	1001

4. Find the total salary expenditure for each clinic:

```
SELECT clinic.clinic_name, SUM(staff.salary) AS total_salary
FROM clinic
JOIN staff ON clinic.clinic_ID = staff.s_clinic_id
GROUP BY clinic.clinic_name;
```

$\pi_{\text{clinic.clinic\_name}}, \mathcal{F}_{\text{SUM}}(\text{staff.salary})$ AS total_salary($\gamma_{\text{clinic.clinic\_name}}$, $\mathcal{F}_{\text{SUM}}(\text{staff.salary})(\text{clinic} \bowtie_{\text{clinic.clinic\_ID = staff.s\_clinic\_id}} \text{staff})$)

CLINIC_NAME	TOTAL_SALARY
Health	70000
Rural	50000
Hearing	70000
Dental	49000

5.Find all patients who have an appointment (reserved) in more than a specific number of clinics:

```
SELECT r_patient_ID, COUNT(r_clinic_ID) AS clinic_count
FROM reserve_in
GROUP BY r_patient_ID
HAVING COUNT(r_clinic_ID) > 0;
```

R_PATIENT_ID	CLINIC_COUNT
2001	1
2002	1
2003	1
2004	1

6. Retrieve the total amount and VAT for invoices of a specific patient:

```
SELECT patient_ID,
(SELECT SUM(total_amount) FROM invoice JOIN pay ON
invoice.invoice_ID = pay.pa_invoice_ID WHERE pay.pa_patient_ID =
patient.patient_ID) AS total_amount,
 (SELECT SUM(VAT) FROM invoice JOIN pay ON invoice.invoice_ID =
pay.pa_invoice_ID WHERE pay.pa_patient_ID = patient.patient_ID) AS
total_VAT
FROM patient
WHERE patient_ID = 2003;
```

PATIENT_ID	TOTAL_AMOUNT	TOTAL_VAT
2003	1190	179

7. Find the clinic with the highest number of patients:

```
SELECT clinic_name
FROM (
   SELECT clinic_name, COUNT(pr_patient_ID) AS total_patients
   FROM clinic
   JOIN provideing ON clinic.clinic_ID = provideing.pr_clinic_ID
   GROUP BY clinic_name
   ORDER BY total_patients DESC)
```

CLINIC_NAME
Rural
Dental
Hearing

8. Find the highest paid staff member in each clinic:

```
SELECT s_clinic_id, staff_name, salary
FROM staff
WHERE (s_clinic_id, salary) IN (SELECT s_clinic_id, MAX(salary)
   FROM staff
   GROUP BY s_clinic_id);
```

$\pi_{s\_clinic\_id,\ staff\_name,\ salary}(\sigma_{(s\_clinic\_id,\ salary)}$ IN $(\gamma_{s\_clinic\_id}, \mathcal{F}_{MAX}(salary)(staff))$

S_CLINIC_ID	STAFF_NAME	SALARY
1001	Wassem	30000
1002	Fatima	30000
1003	Abdullah	30000
1004	Khaled	30000

9. Find the number of staff members supervised by each supervisor

```
SELECT supervisor, COUNT(SSN) AS
num_staff
FROM staff
GROUP BY supervisor;
```

$\pi_{supervisor}, \mathcal{F}_{COUNT}(SSN)$ AS num_staff($\gamma_{supervisor}, \mathcal{F}_{COUNT}(SSN)$(staff))

SUPERVISOR	NUM_STAFF
8954	1
8120	1
8254	1
8820	1
8911	1
-	4
8409	1

10. Find the total number of invoices generated and paid by each clinic:

```
SELECT clinic_name,
    (SELECT COUNT(*) FROM invoice WHERE invoice.I_clinic_ID = clinic.clinic_ID) AS total_invoices,
    (SELECT COUNT(*) FROM pay JOIN invoice ON pay.pa_invoice_ID = invoice.invoice_ID WHERE invoice.I_clinic_ID = clinic.clinic_ID) AS paid_invoices
FROM clinic;
```

CLINIC_NAME	TOTAL_INVOICES	PAID_INVOICES
Dental	2	2
Hearing	3	3
Rural	3	3
Health	2	2