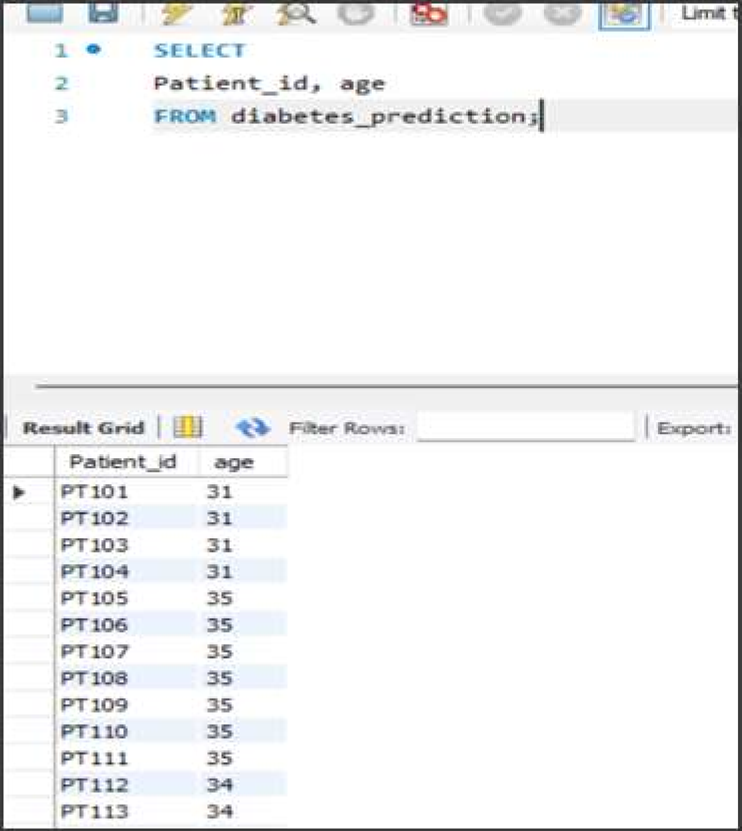
PSYLIQ

Data Analyst Internship

# TASK 3: DIABETES PREDICTION ANALYSIS BY AMAN SHAIKH

# Q1. Retrieve the Patient_id and ages of all patients.

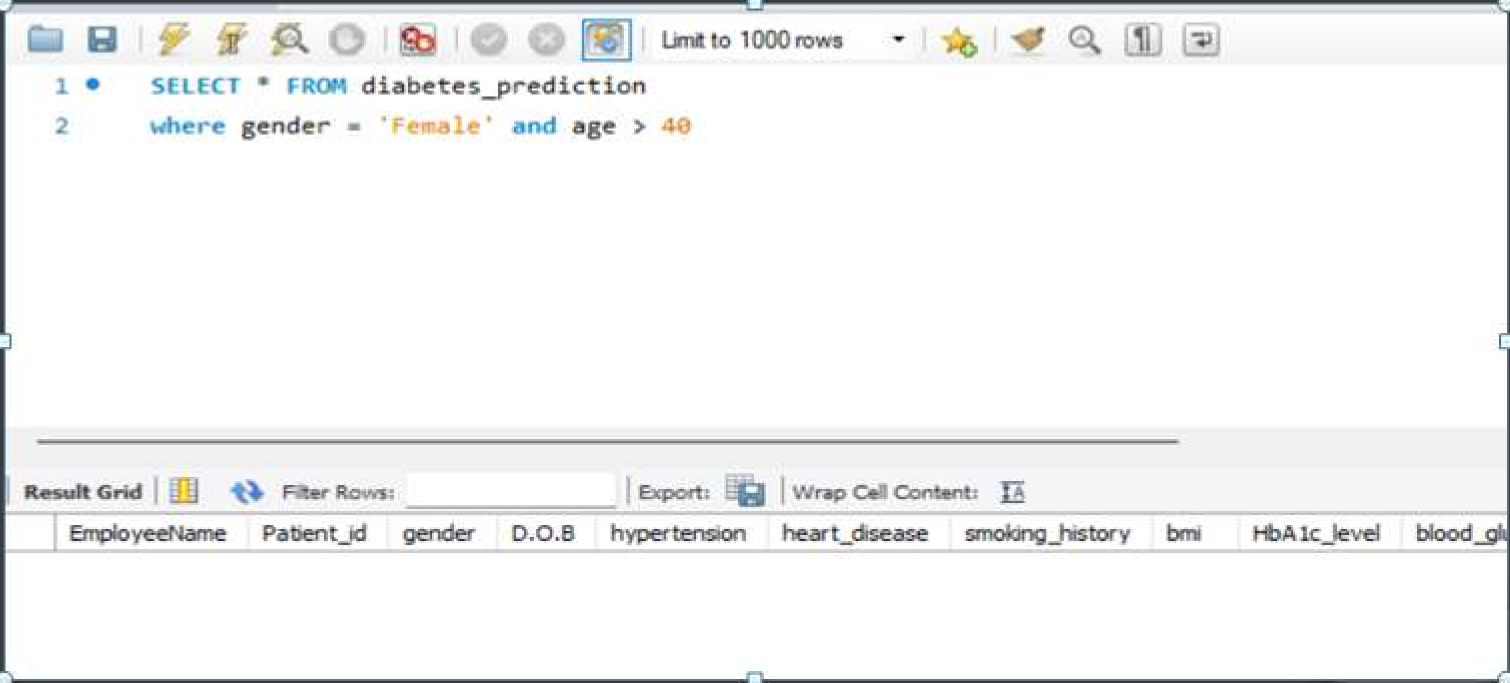


```
SELECT
Patient_id, age
FROM diabetes_prediction;
```

| Patient_id | age |
|---|---|
| PT101 | 31 |
| PT102 | 31 |
| PT103 | 31 |
| PT104 | 31 |
| PT105 | 35 |
| PT106 | 35 |
| PT107 | 35 |
| PT108 | 35 |
| PT109 | 35 |
| PT110 | 35 |
| PT111 | 35 |
| PT112 | 34 |
| PT113 | 34 |

# Q2. Select all female patients who are older than 40.

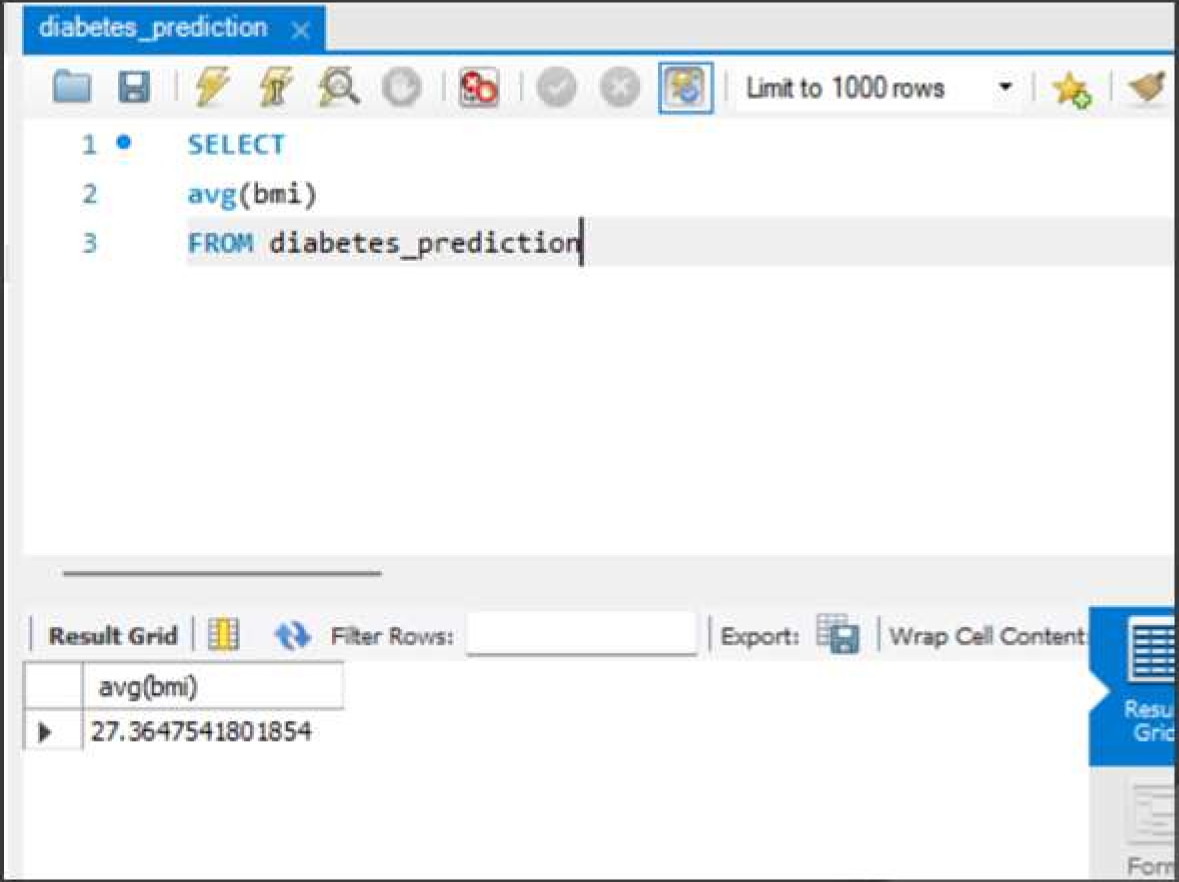
In our patient population, there are no female individuals exceeding the age of 40.



```
SELECT * FROM diabetes_prediction
where gender = 'Female' and age > 40
```

| EmployeeName | Patient_id | gender | D.O.B | hypertension | heart_disease | smoking_history | bmi | HbA1c_level | blood_gl |
|---|---|---|---|---|---|---|---|---|---|

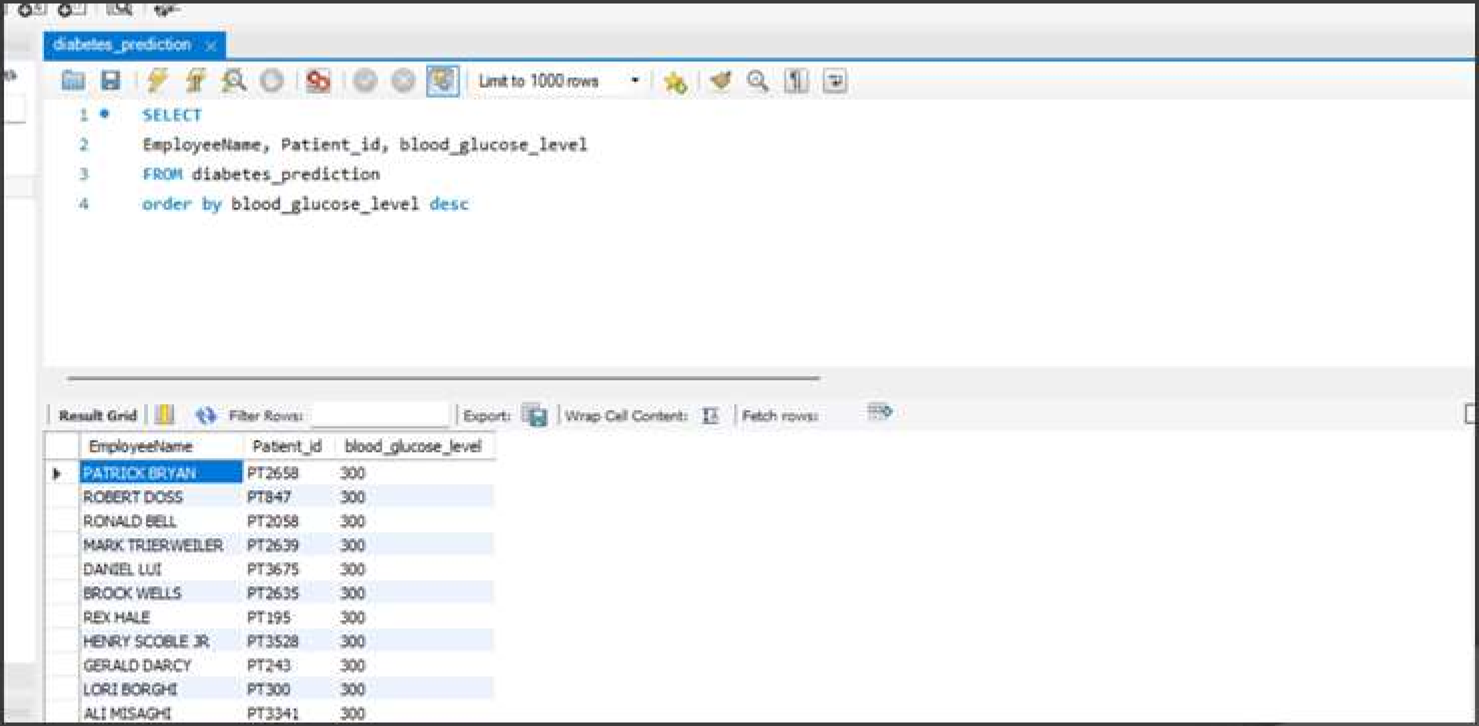
# Q3. Calculate the average BMI of patients.



```
SELECT
avg(bmi)
FROM diabetes_prediction
```

```
avg(bmi)
27.3647541801854
```

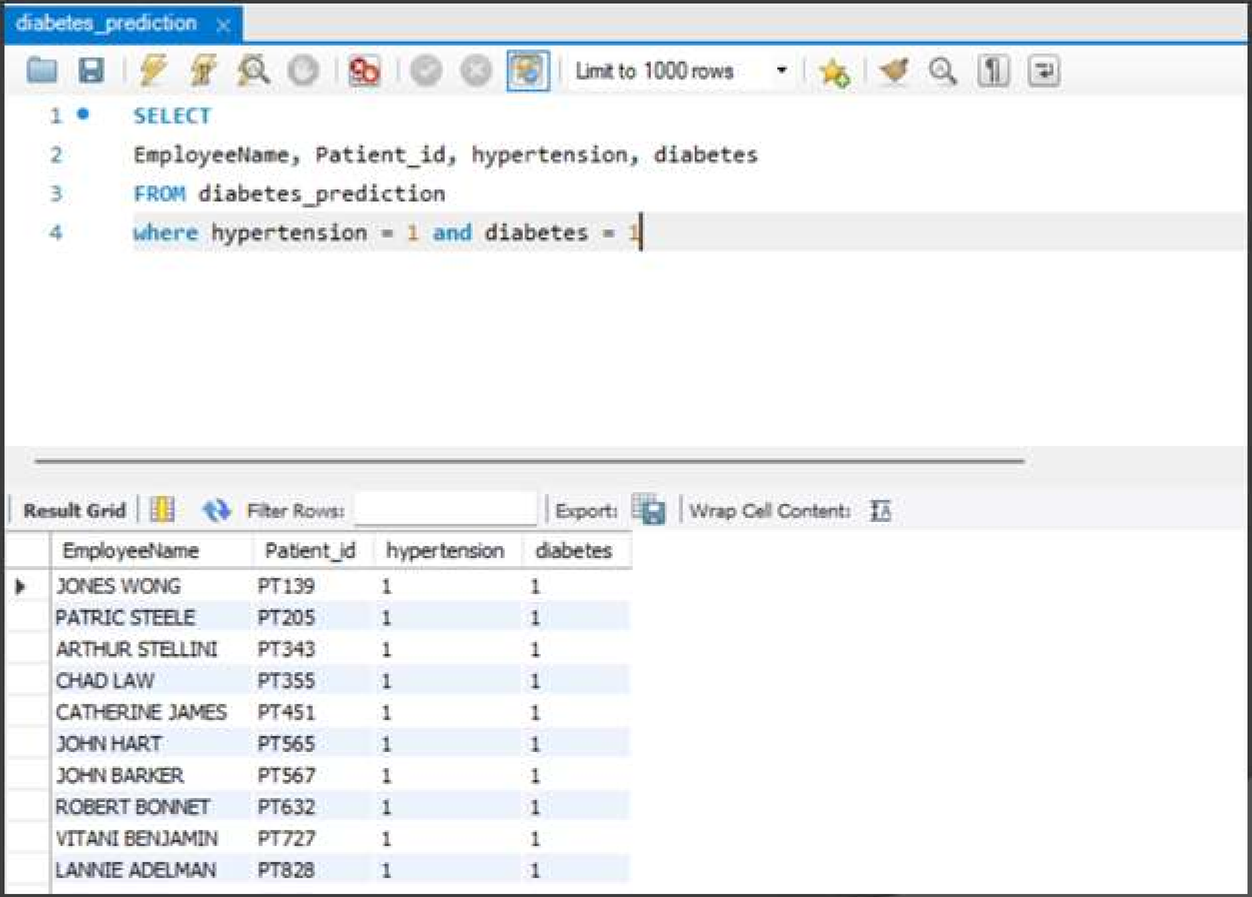
# Q4. List patients in descending order of blood glucose levels.



```sql
SELECT
EmployeeName, Patient_id, blood_glucose_level
FROM diabetes_prediction
order by blood_glucose_level desc
```

| EmployeeName | Patient_id | blood_glucose_level |
|---|---|---|
| PATRICK BRYAN | PT2658 | 300 |
| ROBERT DOSS | PT847 | 300 |
| RONALD BELL | PT2058 | 300 |
| MARK TRIERWEILER | PT2639 | 300 |
| DANIEL LUI | PT3675 | 300 |
| BROCK WELLS | PT2635 | 300 |
| REX HALE | PT195 | 300 |
| HENRY SCOBLE JR | PT3528 | 300 |
| GERALD DARCY | PT243 | 300 |
| LORI BORGHI | PT300 | 300 |
| ALI MISAGHI | PT3341 | 300 |

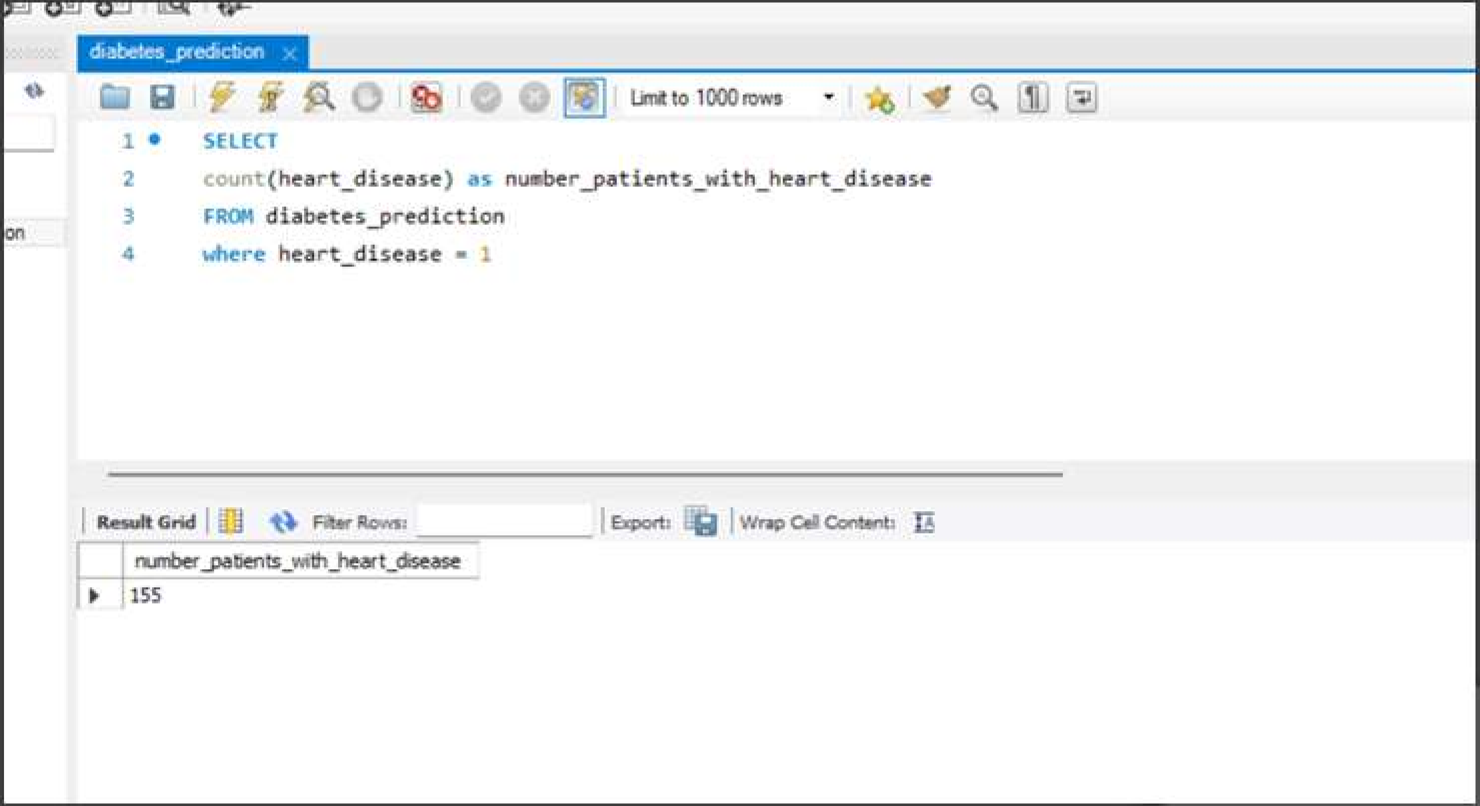
# Q5. Find patients who have hypertension and diabetes.



```sql
SELECT
EmployeeName, Patient_id, hypertension, diabetes
FROM diabetes_prediction
where hypertension = 1 and diabetes = 1
```

| EmployeeName | Patient_id | hypertension | diabetes |
|---|---|---|---|
| JONES WONG | PT139 | 1 | 1 |
| PATRIC STEELE | PT205 | 1 | 1 |
| ARTHUR STELLINI | PT343 | 1 | 1 |
| CHAD LAW | PT355 | 1 | 1 |
| CATHERINE JAMES | PT451 | 1 | 1 |
| JOHN HART | PT565 | 1 | 1 |
| JOHN BARKER | PT567 | 1 | 1 |
| ROBERT BONNET | PT632 | 1 | 1 |
| VITANI BENJAMIN | PT727 | 1 | 1 |
| LANNIE ADELMAN | PT828 | 1 | 1 |

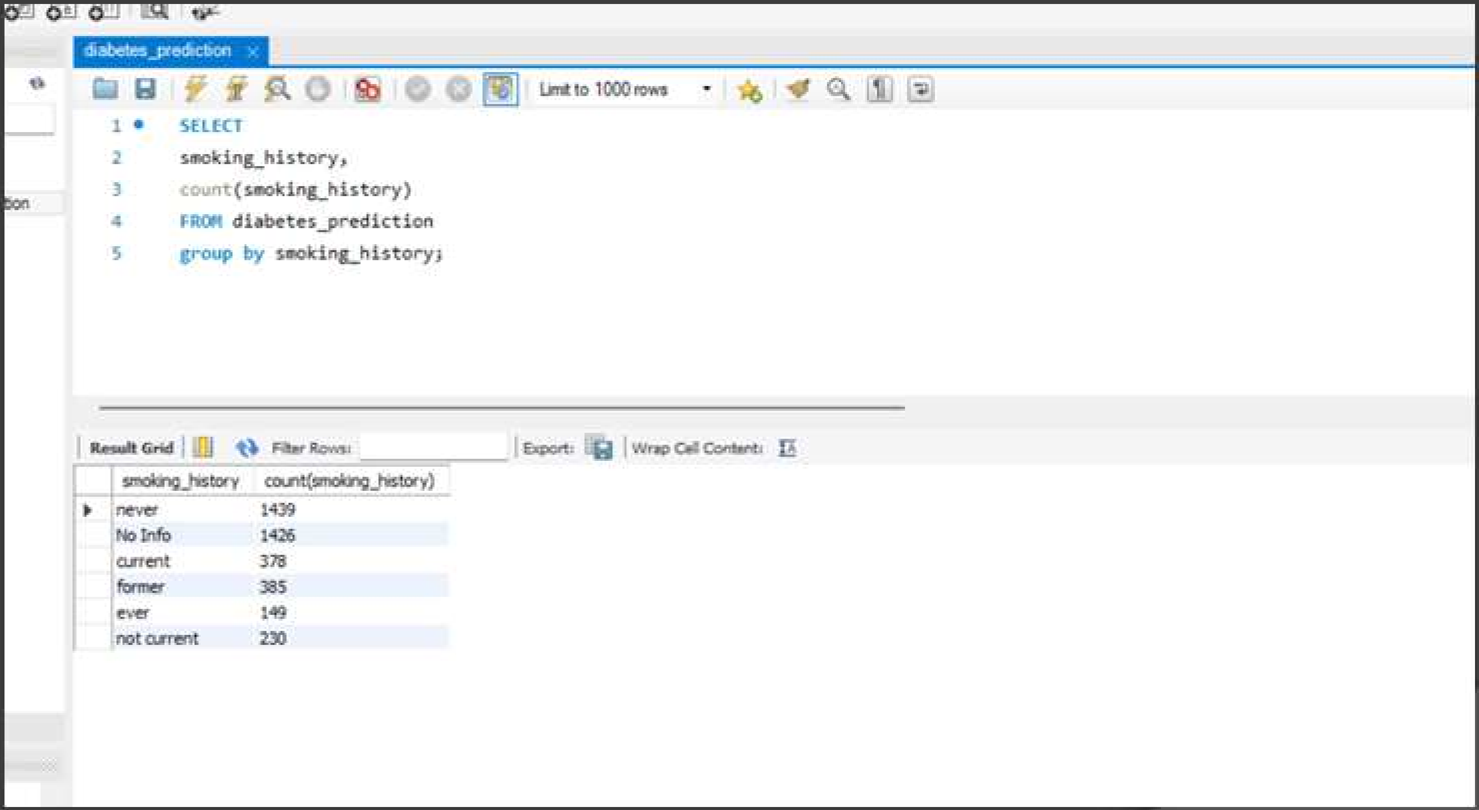
# Q6. Determine the number of patients with heart disease.



```
SELECT
count(heart_disease) as number_patients_with_heart_disease
FROM diabetes_prediction
where heart_disease = 1
```

```
number_patients_with_heart_disease
155
```

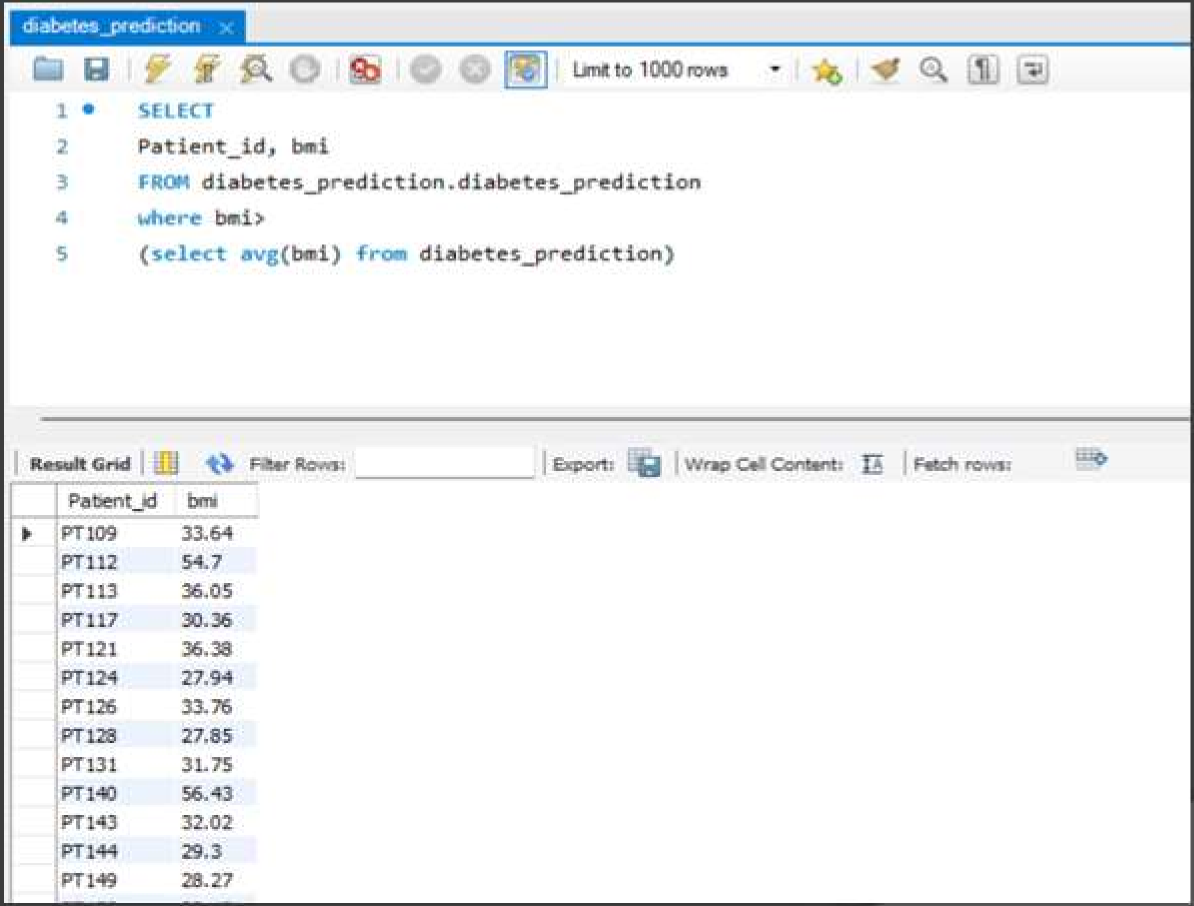
# Q7. Group patients by smoking history and count how many smokers and nonsmokers there are.



```sql
SELECT
smoking_history,
count(smoking_history)
FROM diabetes_prediction
group by smoking_history;
```

| smoking_history | count(smoking_history) |
|---|---|
| never | 1439 |
| No Info | 1426 |
| current | 378 |
| former | 385 |
| ever | 149 |
| not current | 230 |

# Q8. Retrieve the Patient_ids of patients who have a BMI greater than the average BMI.

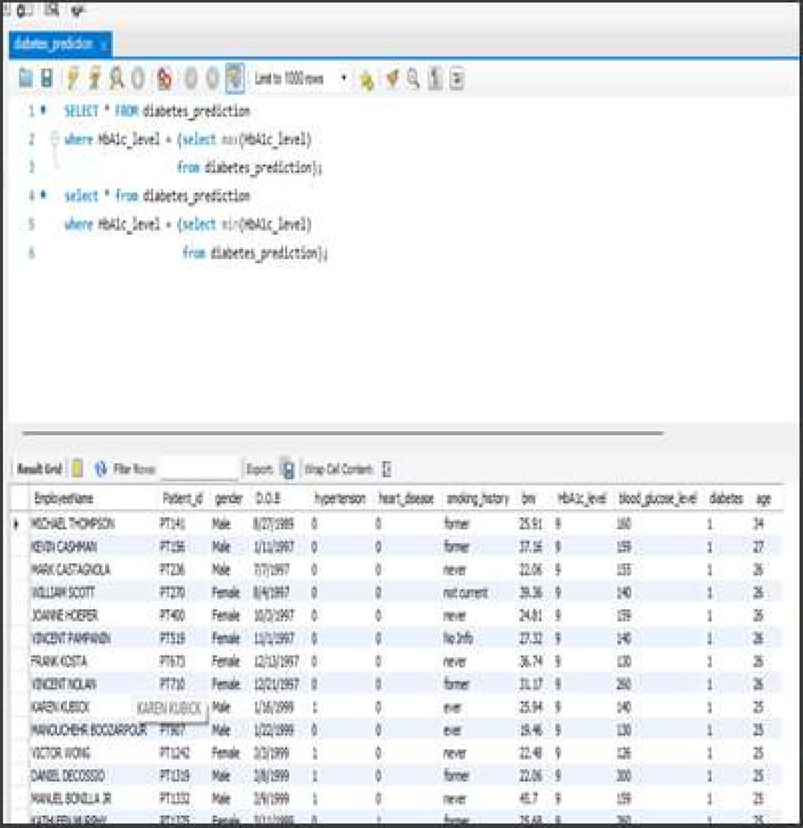


```sql
SELECT
Patient_id, bmi
FROM diabetes_prediction.diabetes_prediction
where bmi>
(select avg(bmi) from diabetes_prediction)
```

| Patient_id | bmi |
|---|---|
| PT109 | 33.64 |
| PT112 | 54.7 |
| PT113 | 36.05 |
| PT117 | 30.36 |
| PT121 | 36.38 |
| PT124 | 27.94 |
| PT126 | 33.76 |
| PT128 | 27.85 |
| PT131 | 31.75 |
| PT140 | 56.43 |
| PT143 | 32.02 |
| PT144 | 29.3 |
| PT149 | 28.27 |

# Q9. Find the patient with the highest HbA1c level and the patient with the lowest HbA1clevel.

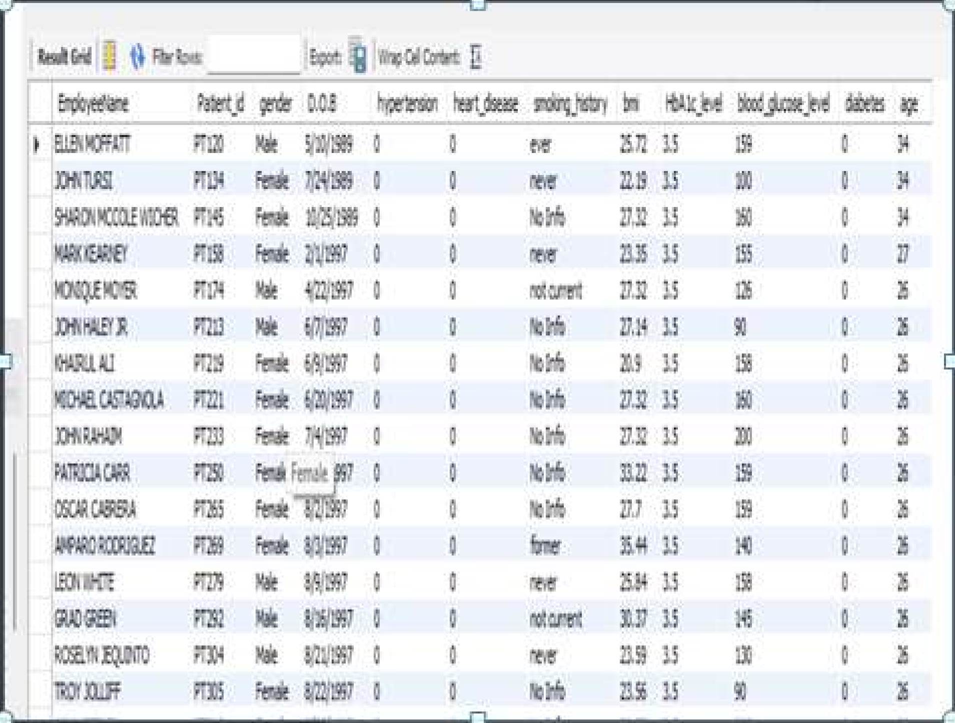
- Highest



```sql
SELECT * FROM diabetes_prediction
where HbA1c_level = (select max(HbA1c_level)
                     from diabetes_prediction);
select * from diabetes_prediction
where HbA1c_level = (select min(HbA1c_level)
                     from diabetes_prediction);
```

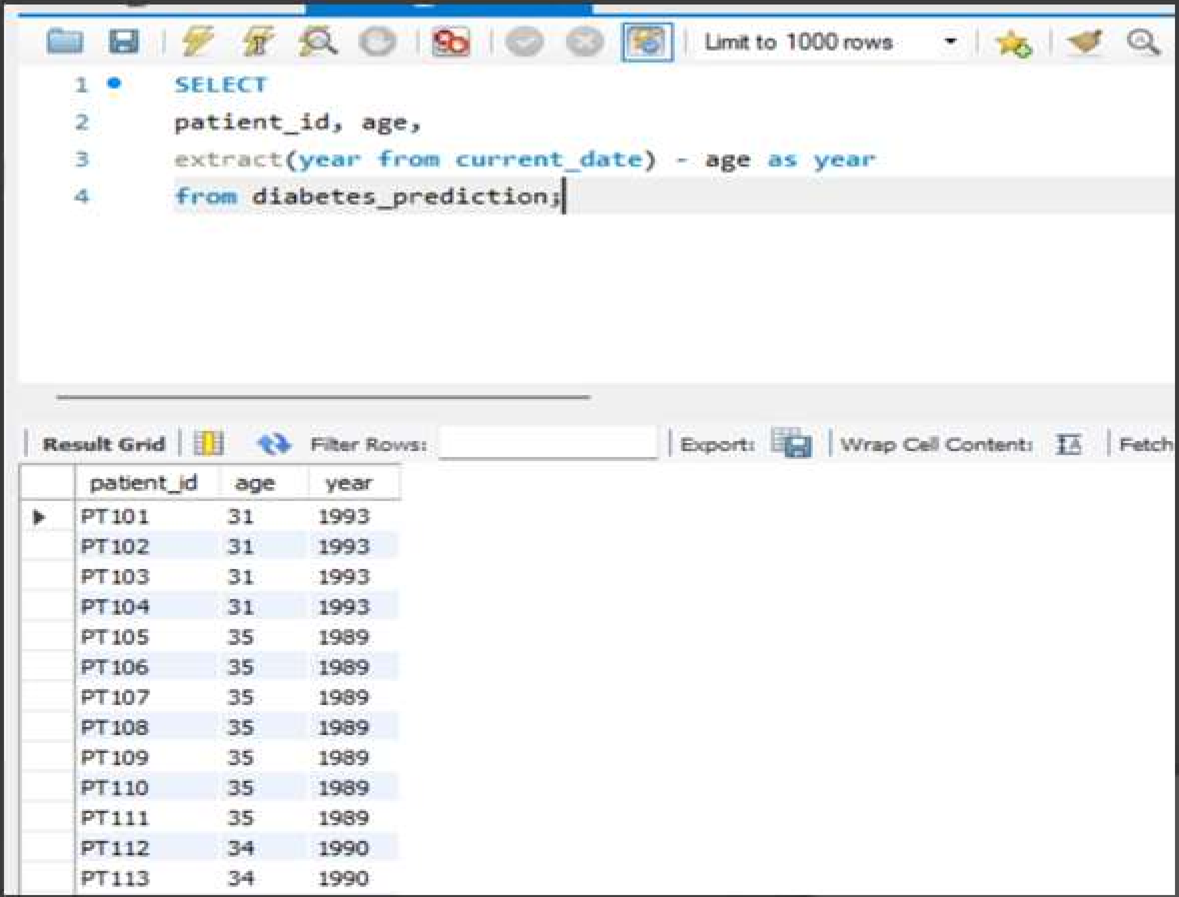
| EmployeeName | Patient_id | gender | D.O.B | hypertension | heart_disease | smoking_history | bmi | HbA1c_level | blood_glucose_level | diabetes | age |
|---|---|---|---|---|---|---|---|---|---|---|---|
| MICHAEL THOMPSON | PT141 | Male | 8/27/1989 | 0 | 0 | former | 25.91 | 9 | 160 | 1 | 34 |
| KEVIN CASHMAN | PT196 | Male | 1/11/1997 | 0 | 0 | former | 37.16 | 9 | 159 | 1 | 27 |
| MARK CASTAGNOLA | PT236 | Male | 7/7/1997 | 0 | 0 | never | 22.06 | 9 | 155 | 1 | 26 |
| WILLIAM SCOTT | PT270 | Female | 8/4/1997 | 0 | 0 | not current | 39.36 | 9 | 140 | 1 | 26 |
| JOANNE HOEPER | PT400 | Female | 10/3/1997 | 0 | 0 | never | 24.81 | 9 | 159 | 1 | 26 |
| VINCENT PAMPANIN | PT519 | Female | 11/1/1997 | 0 | 0 | No Info | 27.32 | 9 | 140 | 1 | 26 |
| FRANK KOSTA | PT673 | Female | 12/13/1997 | 0 | 0 | never | 36.74 | 9 | 130 | 1 | 26 |
| VINCENT NOLAN | PT710 | Female | 12/21/1997 | 0 | 0 | former | 31.17 | 9 | 260 | 1 | 26 |
| KAREN KUBICK | KAREN KUBICK | Male | 1/16/1999 | 1 | 0 | ever | 25.94 | 9 | 140 | 1 | 25 |
| MANOUCHEHR BOOZARPOUR | PT907 | Male | 1/22/1999 | 0 | 0 | ever | 19.46 | 9 | 130 | 1 | 25 |
| VICTOR WONG | PT1242 | Female | 2/3/1999 | 1 | 0 | never | 22.48 | 9 | 126 | 1 | 25 |
| DANIEL DECOSSIO | PT1319 | Male | 3/8/1999 | 1 | 0 | former | 22.06 | 9 | 300 | 1 | 25 |
| MANUEL BONILLA JR | PT1332 | Male | 3/9/1999 | 1 | 0 | never | 45.7 | 9 | 159 | 1 | 25 |
| [illegible] | PT1375 | Female | [illegible] | 0 | 1 | former | 25.68 | 9 | 260 | 1 | 25 |

- Lowest



| EmployeeName | Patient_id | gender | D.O.B | hypertension | heart_disease | smoking_history | bmi | HbA1c_level | blood_glucose_level | diabetes | age |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ELLEN MOFFATT | PT120 | Male | 5/10/1989 | 0 | 0 | ever | 25.72 | 3.5 | 159 | 0 | 34 |
| JOHN TURSI | PT134 | Female | 7/24/1989 | 0 | 0 | never | 22.19 | 3.5 | 100 | 0 | 34 |
| SHARON MCCOLE WICHER | PT145 | Female | 10/25/1989 | 0 | 0 | No Info | 27.32 | 3.5 | 160 | 0 | 34 |
| MARK KEARNEY | PT158 | Female | 2/1/1997 | 0 | 0 | never | 23.35 | 3.5 | 155 | 0 | 27 |
| MONIQUE MOYER | PT174 | Male | 4/22/1997 | 0 | 0 | not current | 27.32 | 3.5 | 126 | 0 | 26 |
| JOHN HALEY JR | PT213 | Male | 6/7/1997 | 0 | 0 | No Info | 27.14 | 3.5 | 90 | 0 | 26 |
| KHAIRUL ALI | PT219 | Female | 6/9/1997 | 0 | 0 | No Info | 20.9 | 3.5 | 158 | 0 | 26 |
| MICHAEL CASTAGNOLA | PT221 | Female | 6/20/1997 | 0 | 0 | No Info | 27.32 | 3.5 | 160 | 0 | 26 |
| JOHN RAHAIM | PT233 | Female | 7/4/1997 | 0 | 0 | No Info | 27.32 | 3.5 | 200 | 0 | 26 |
| PATRICIA CARR | PT250 | Female | Female 997 | 0 | 0 | No Info | 33.22 | 3.5 | 159 | 0 | 26 |
| OSCAR CABRERA | PT265 | Female | 8/2/1997 | 0 | 0 | No Info | 27.7 | 3.5 | 159 | 0 | 26 |
| AMPARO RODRIGUEZ | PT269 | Female | 8/3/1997 | 0 | 0 | former | 35.44 | 3.5 | 140 | 0 | 26 |
| LEON WHITE | PT279 | Male | 8/9/1997 | 0 | 0 | never | 25.84 | 3.5 | 158 | 0 | 26 |
| GRAD GREEN | PT292 | Male | 8/16/1997 | 0 | 0 | not current | 30.37 | 3.5 | 145 | 0 | 26 |
| ROSELYN JEQUINTO | PT304 | Male | 8/21/1997 | 0 | 0 | never | 23.59 | 3.5 | 130 | 0 | 26 |
| TROY JOLLIFF | PT305 | Female | 8/22/1997 | 0 | 0 | No Info | 23.56 | 3.5 | 90 | 0 | 26 |

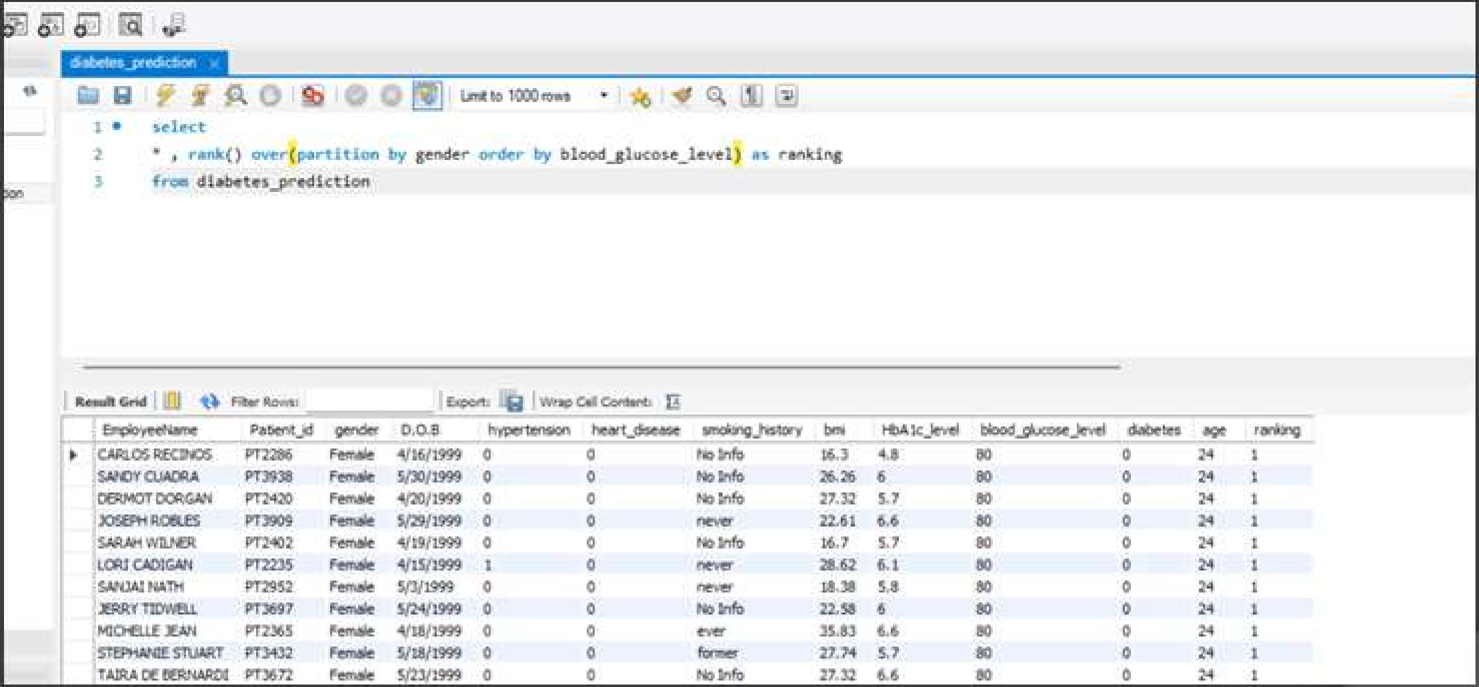
# Q10. Calculate the age of patients in years (assuming the current date as of now).



```sql
SELECT
patient_id, age,
extract(year from current_date) - age as year
from diabetes_prediction;
```

| patient_id | age | year |
|---|---|---|
| PT101 | 31 | 1993 |
| PT102 | 31 | 1993 |
| PT103 | 31 | 1993 |
| PT104 | 31 | 1993 |
| PT105 | 35 | 1989 |
| PT106 | 35 | 1989 |
| PT107 | 35 | 1989 |
| PT108 | 35 | 1989 |
| PT109 | 35 | 1989 |
| PT110 | 35 | 1989 |
| PT111 | 35 | 1989 |
| PT112 | 34 | 1990 |
| PT113 | 34 | 1990 |

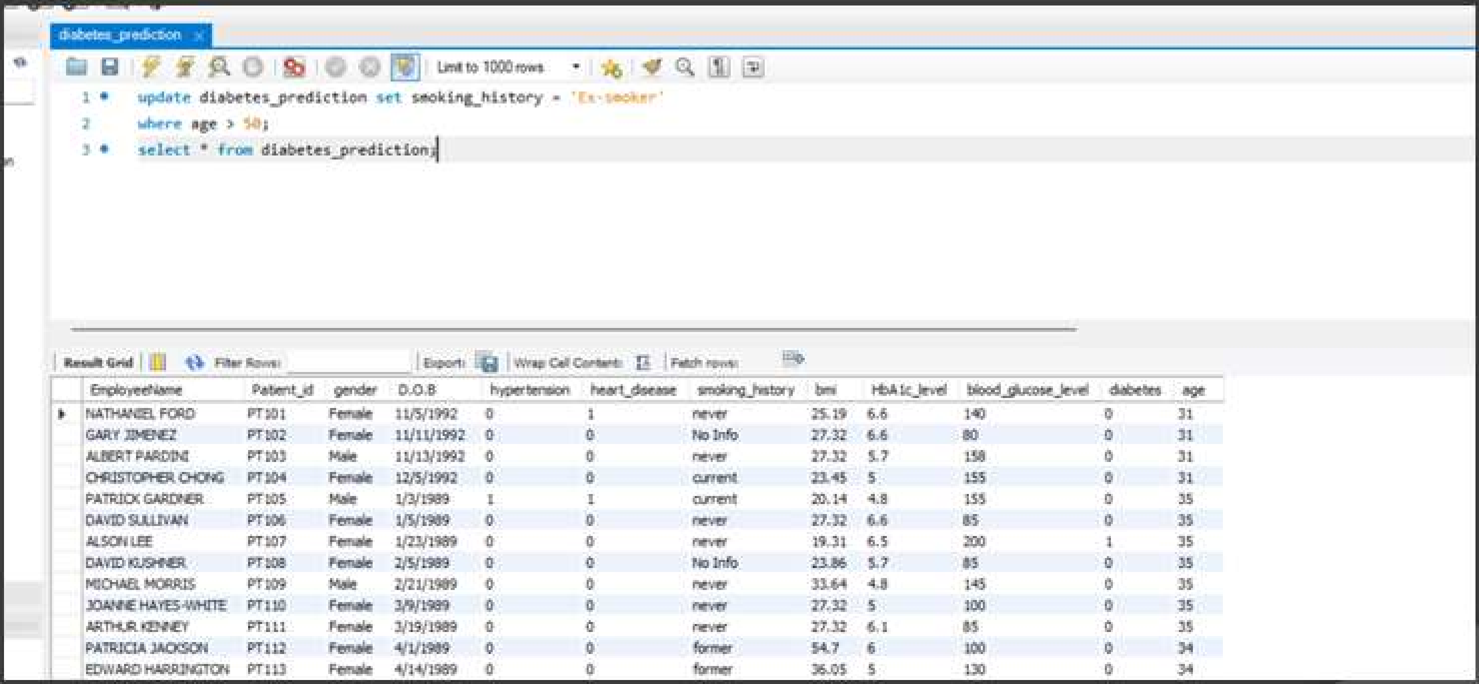
# Q11. Rank patients by blood glucose level within each gender group.



```
select
* , rank() over(partition by gender order by blood_glucose_level) as ranking
from diabetes_prediction
```

| EmployeeName | Patient_id | gender | D.O.B | hypertension | heart_disease | smoking_history | bmi | HbA1c_level | blood_glucose_level | diabetes | age | ranking |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CARLOS RECINOS | PT2286 | Female | 4/16/1999 | 0 | 0 | No Info | 16.3 | 4.8 | 80 | 0 | 24 | 1 |
| SANDY CUADRA | PT3938 | Female | 5/30/1999 | 0 | 0 | No Info | 26.26 | 6 | 80 | 0 | 24 | 1 |
| DERMOT DORGAN | PT2420 | Female | 4/20/1999 | 0 | 0 | No Info | 27.32 | 5.7 | 80 | 0 | 24 | 1 |
| JOSEPH ROBLES | PT3909 | Female | 5/29/1999 | 0 | 0 | never | 22.61 | 6.6 | 80 | 0 | 24 | 1 |
| SARAH WILNER | PT2402 | Female | 4/19/1999 | 0 | 0 | No Info | 16.7 | 5.7 | 80 | 0 | 24 | 1 |
| LORI CADIGAN | PT2235 | Female | 4/15/1999 | 1 | 0 | never | 28.62 | 6.1 | 80 | 0 | 24 | 1 |
| SANJAI NATH | PT2952 | Female | 5/3/1999 | 0 | 0 | never | 18.38 | 5.8 | 80 | 0 | 24 | 1 |
| JERRY TIDWELL | PT3697 | Female | 5/24/1999 | 0 | 0 | No Info | 22.58 | 6 | 80 | 0 | 24 | 1 |
| MICHELLE JEAN | PT2365 | Female | 4/18/1999 | 0 | 0 | ever | 35.83 | 6.6 | 80 | 0 | 24 | 1 |
| STEPHANIE STUART | PT3432 | Female | 5/18/1999 | 0 | 0 | former | 27.74 | 5.7 | 80 | 0 | 24 | 1 |
| TAIRA DE BERNARDI | PT3672 | Female | 5/23/1999 | 0 | 0 | No Info | 27.32 | 6.6 | 80 | 0 | 24 | 1 |

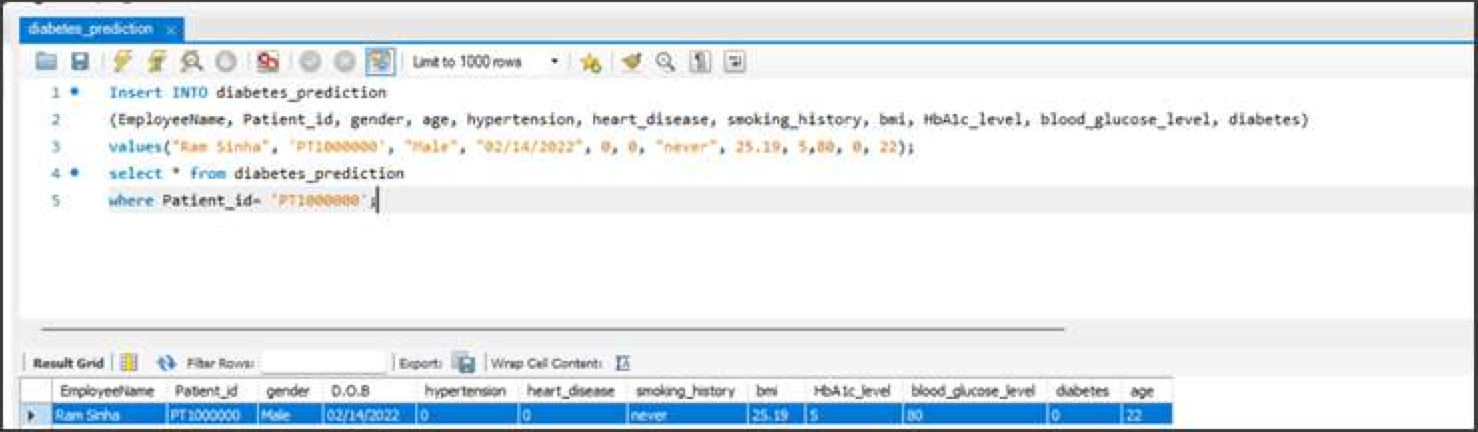
# Q12. Update the smoking history of patients who are older than 50 to "Ex-smoker."



```sql
update diabetes_prediction set smoking_history = 'Ex-smoker'
where age > 50;
select * from diabetes_prediction;
```

| EmployeeName | Patient_id | gender | D.O.B | hypertension | heart_disease | smoking_history | bmi | HbA1c_level | blood_glucose_level | diabetes | age |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NATHANIEL FORD | PT101 | Female | 11/5/1992 | 0 | 1 | never | 25.19 | 6.6 | 140 | 0 | 31 |
| GARY JIMENEZ | PT102 | Female | 11/11/1992 | 0 | 0 | No Info | 27.32 | 6.6 | 80 | 0 | 31 |
| ALBERT PARDINI | PT103 | Male | 11/13/1992 | 0 | 0 | never | 27.32 | 5.7 | 158 | 0 | 31 |
| CHRISTOPHER CHONG | PT104 | Female | 12/5/1992 | 0 | 0 | current | 23.45 | 5 | 155 | 0 | 31 |
| PATRICK GARDNER | PT105 | Male | 1/3/1989 | 1 | 1 | current | 20.14 | 4.8 | 155 | 0 | 35 |
| DAVID SULLIVAN | PT106 | Female | 1/5/1989 | 0 | 0 | never | 27.32 | 6.6 | 85 | 0 | 35 |
| ALSON LEE | PT107 | Female | 1/23/1989 | 0 | 0 | never | 19.31 | 6.5 | 200 | 1 | 35 |
| DAVID KUSHNER | PT108 | Female | 2/5/1989 | 0 | 0 | No Info | 23.86 | 5.7 | 85 | 0 | 35 |
| MICHAEL MORRIS | PT109 | Male | 2/21/1989 | 0 | 0 | never | 33.64 | 4.8 | 145 | 0 | 35 |
| JOANNE HAYES-WHITE | PT110 | Female | 3/9/1989 | 0 | 0 | never | 27.32 | 5 | 100 | 0 | 35 |
| ARTHUR KENNEY | PT111 | Female | 3/19/1989 | 0 | 0 | never | 27.32 | 6.1 | 85 | 0 | 35 |
| PATRICIA JACKSON | PT112 | Female | 4/1/1989 | 0 | 0 | former | 54.7 | 6 | 100 | 0 | 34 |
| EDWARD HARRINGTON | PT113 | Female | 4/14/1989 | 0 | 0 | former | 36.05 | 5 | 130 | 0 | 34 |

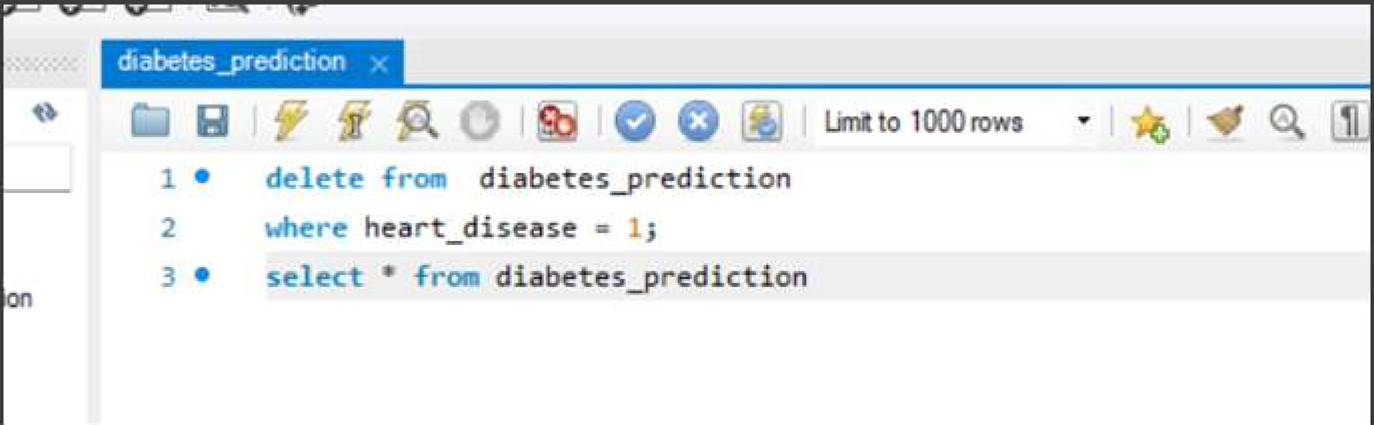
# Q13. Insert a new patient into the database with sample data.



```
Insert INTO diabetes_prediction
(EmployeeName, Patient_id, gender, age, hypertension, heart_disease, smoking_history, bmi, HbA1c_level, blood_glucose_level, diabetes)
values("Ram Sinha", 'PT1000000', "Male", "02/14/2022", 0, 0, "never", 25.19, 5,80, 0, 22);
select * from diabetes_prediction
where Patient_id= 'PT1000000';
```

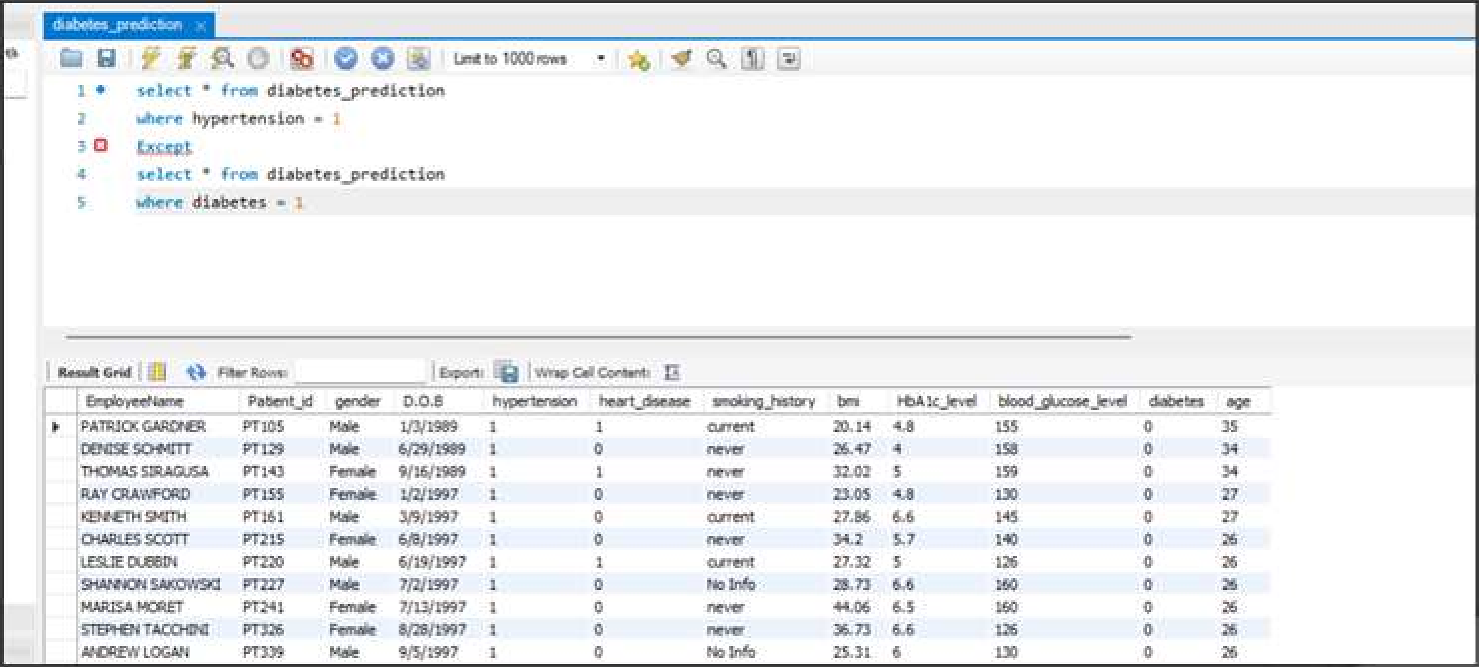
| EmployeeName | Patient_id | gender | D.O.B | hypertension | heart_disease | smoking_history | bmi | HbA1c_level | blood_glucose_level | diabetes | age |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ram Sinha | PT1000000 | Male | 02/14/2022 | 0 | 0 | never | 25.19 | 5 | 80 | 0 | 22 |

# Q14. Delete all patients with heart disease from the database.



```
delete from  diabetes_prediction
where heart_disease = 1;
select * from diabetes_prediction
```

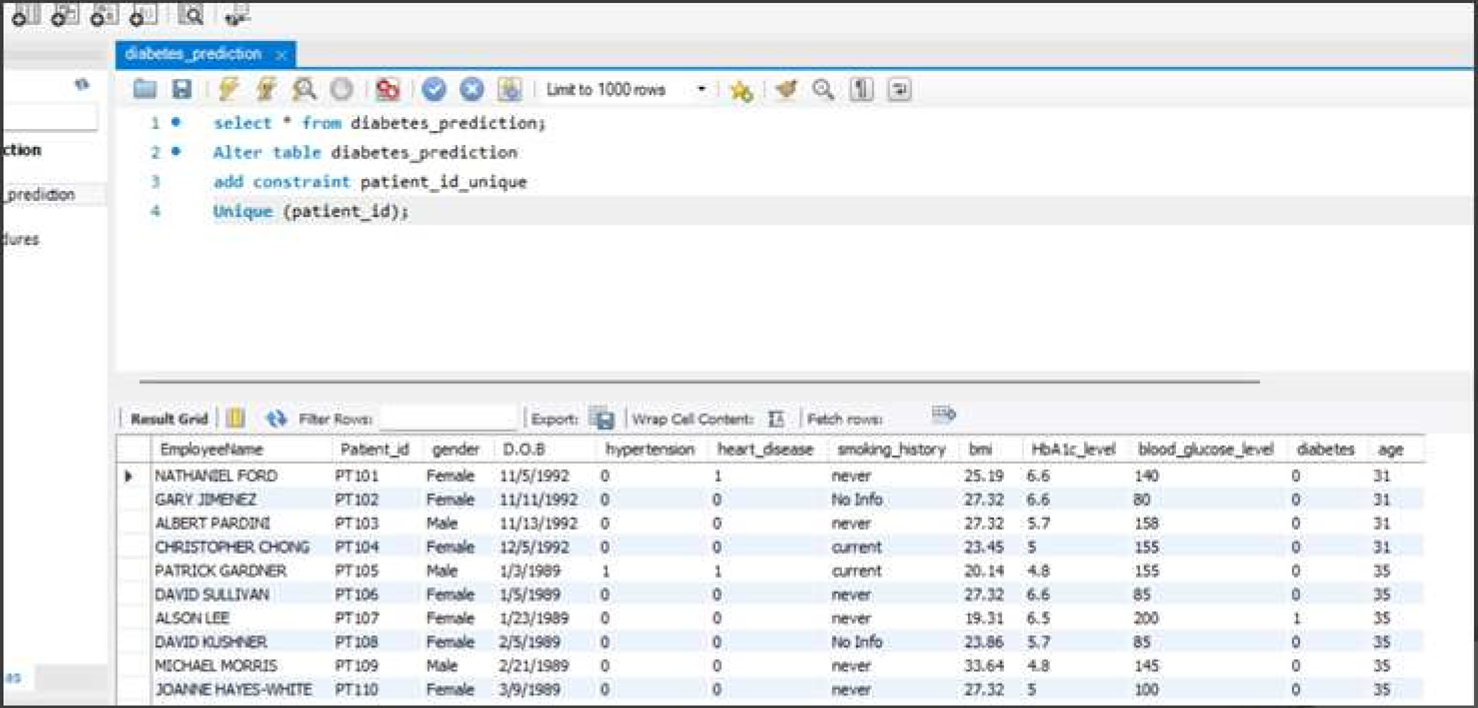
# Q15. Find patients who have hypertension but not diabetes using the EXCEPT operator.



```
select * from diabetes_prediction
where hypertension = 1
Except
select * from diabetes_prediction
where diabetes = 1
```

| EmployeeName | Patient_id | gender | D.O.B | hypertension | heart_disease | smoking_history | bmi | HbA1c_level | blood_glucose_level | diabetes | age |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PATRICK GARDNER | PT105 | Male | 1/3/1989 | 1 | 1 | current | 20.14 | 4.8 | 155 | 0 | 35 |
| DENISE SCHMITT | PT129 | Male | 6/29/1989 | 1 | 0 | never | 26.47 | 4 | 158 | 0 | 34 |
| THOMAS SIRAGUSA | PT143 | Female | 9/16/1989 | 1 | 1 | never | 32.02 | 5 | 159 | 0 | 34 |
| RAY CRAWFORD | PT155 | Female | 1/2/1997 | 1 | 0 | never | 23.05 | 4.8 | 130 | 0 | 27 |
| KENNETH SMITH | PT161 | Male | 3/9/1997 | 1 | 0 | current | 27.86 | 6.6 | 145 | 0 | 27 |
| CHARLES SCOTT | PT215 | Female | 6/8/1997 | 1 | 0 | never | 34.2 | 5.7 | 140 | 0 | 26 |
| LESLIE DUBBIN | PT220 | Male | 6/19/1997 | 1 | 1 | current | 27.32 | 5 | 126 | 0 | 26 |
| SHANNON SAKOWSKI | PT227 | Male | 7/2/1997 | 1 | 0 | No Info | 28.73 | 6.6 | 160 | 0 | 26 |
| MARISA MORET | PT241 | Female | 7/13/1997 | 1 | 0 | never | 44.06 | 6.5 | 160 | 0 | 26 |
| STEPHEN TACCHINI | PT326 | Female | 8/28/1997 | 1 | 0 | never | 36.73 | 6.6 | 126 | 0 | 26 |
| ANDREW LOGAN | PT339 | Male | 9/5/1997 | 1 | 0 | No Info | 25.31 | 6 | 130 | 0 | 26 |

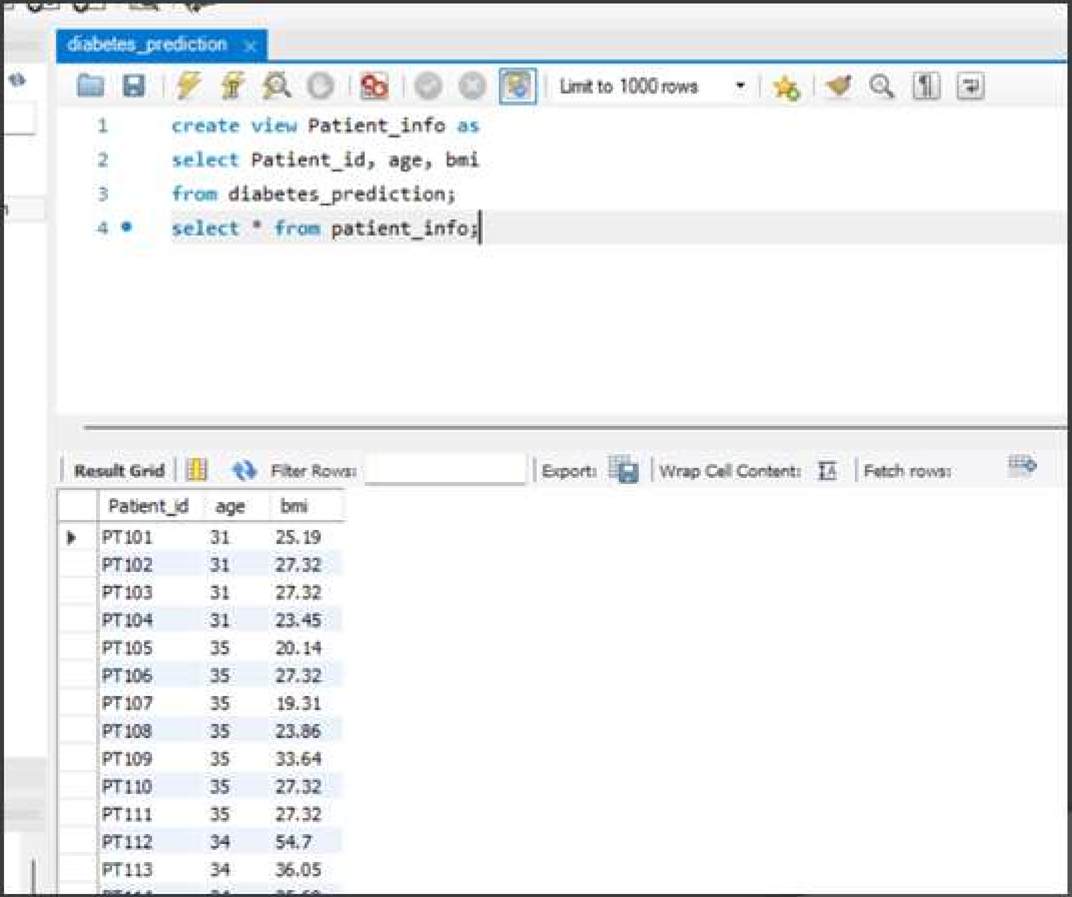
# Q16. Define a unique constraint on the "patient_id" column to ensure its values are unique.



```sql
select * from diabetes_prediction;
Alter table diabetes_prediction
add constraint patient_id_unique
Unique (patient_id);
```

| EmployeeName | Patient_id | gender | D.O.B | hypertension | heart_disease | smoking_history | bmi | HbA1c_level | blood_glucose_level | diabetes | age |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NATHANIEL FORD | PT101 | Female | 11/5/1992 | 0 | 1 | never | 25.19 | 6.6 | 140 | 0 | 31 |
| GARY JIMENEZ | PT102 | Female | 11/11/1992 | 0 | 0 | No Info | 27.32 | 6.6 | 80 | 0 | 31 |
| ALBERT PARDINI | PT103 | Male | 11/13/1992 | 0 | 0 | never | 27.32 | 5.7 | 158 | 0 | 31 |
| CHRISTOPHER CHONG | PT104 | Female | 12/5/1992 | 0 | 0 | current | 23.45 | 5 | 155 | 0 | 31 |
| PATRICK GARDNER | PT105 | Male | 1/3/1989 | 1 | 1 | current | 20.14 | 4.8 | 155 | 0 | 35 |
| DAVID SULLIVAN | PT106 | Female | 1/5/1989 | 0 | 0 | never | 27.32 | 6.6 | 85 | 0 | 35 |
| ALSON LEE | PT107 | Female | 1/23/1989 | 0 | 0 | never | 19.31 | 6.5 | 200 | 1 | 35 |
| DAVID KUSHNER | PT108 | Female | 2/5/1989 | 0 | 0 | No Info | 23.86 | 5.7 | 85 | 0 | 35 |
| MICHAEL MORRIS | PT109 | Male | 2/21/1989 | 0 | 0 | never | 33.64 | 4.8 | 145 | 0 | 35 |
| JOANNE HAYES-WHITE | PT110 | Female | 3/9/1989 | 0 | 0 | never | 27.32 | 5 | 100 | 0 | 35 |

# Q17. Create a view that displays the Patient_ids, ages, and BMI of patients.



```
create view Patient_info as
select Patient_id, age, bmi
from diabetes_prediction;
select * from patient_info;
```

| Patient_id | age | bmi |
|---|---|---|
| PT101 | 31 | 25.19 |
| PT102 | 31 | 27.32 |
| PT103 | 31 | 27.32 |
| PT104 | 31 | 23.45 |
| PT105 | 35 | 20.14 |
| PT106 | 35 | 27.32 |
| PT107 | 35 | 19.31 |
| PT108 | 35 | 23.86 |
| PT109 | 35 | 33.64 |
| PT110 | 35 | 27.32 |
| PT111 | 35 | 27.32 |
| PT112 | 34 | 54.7 |
| PT113 | 34 | 36.05 |

# Q18. Suggest improvements in the database schema to reduce data redundancy and improve data integrity.

1. **Normalization (Up to 3NF):** Organize data into separate tables based on functional dependencies to eliminate redundancy and ensure data integrity.
2. **Primary Keys and Foreign Keys:** Use primary keys to uniquely identify rows in each table and foreign keys to establish relationships between tables, enforcing referential integrity.
3. **Avoid Multi-Valued Dependencies:** Identify and eliminate multi-valued dependencies by decomposing tables or creating separate tables for related attributes to maintain atomicity and data integrity.
4. **Denormalization for Performance**: Consider denormalizing tables or introducing calculated fields to improve query performance, but carefully balance performance gains with the risk of data inconsistency.

# Q19. Explain how you can optimize the performance of SQL queries on this dataset.

1. **Indexing:** Use indexes on columns frequently used in WHERE clauses, JOIN conditions, and ORDER BY clauses to expedite row retrieval.
2. **Optimize Joins:** Prefer INNER JOIN over OUTER JOIN for efficiency. Prioritize smaller tables as driving tables in the join clause.
3. **Avoid SELECT :** Explicitly specify needed columns instead of using SELECT *, reducing data retrieval overhead.
4. **Limit Result Set:** Apply LIMIT clause to restrict the number of rows returned, minimizing data transfer and processing.