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Lab 10(29/10/2021)
Restaurant-Franchise Management System

Relation Algebra and SQL Queries for Functional Requirements

Queries that database would answer:-

1) List all the dishes which are present in all the branches.(Use division).

i) Relational Algebra:-

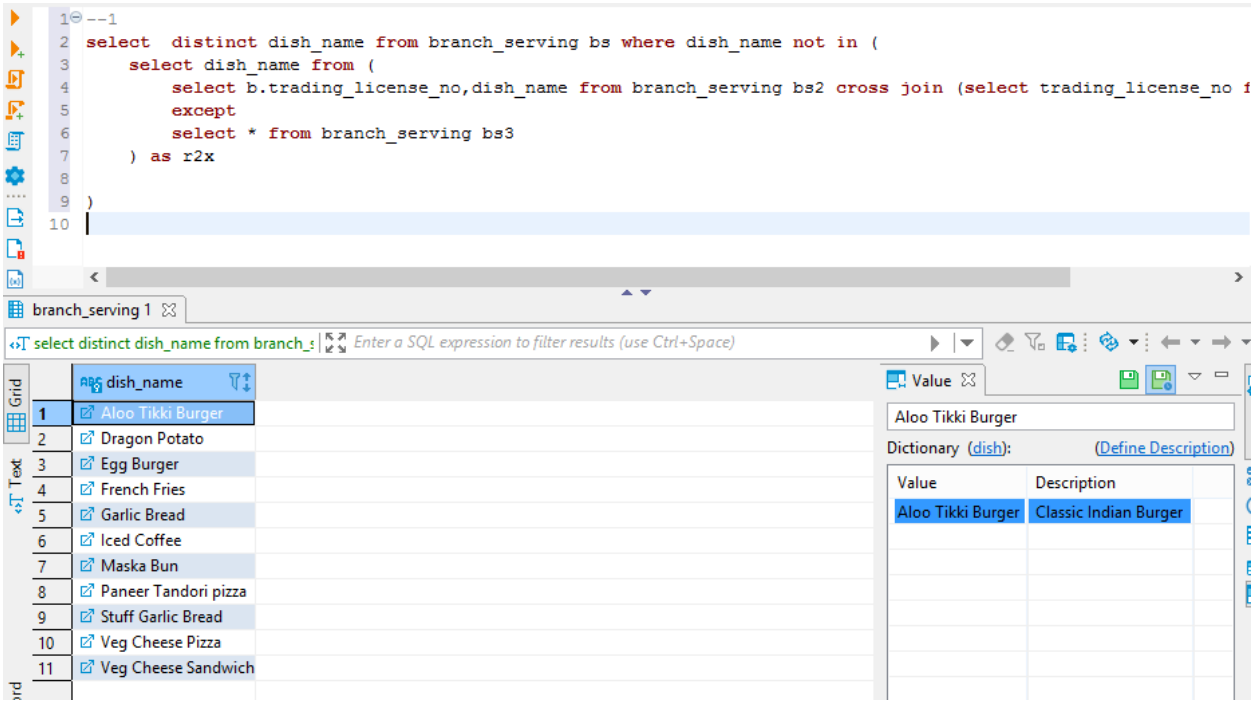
$\prod_{<dish\_name>} \sigma_{dish\_name\ NOT\ IN} (\prod_{dish\_name} \rho(r2 , (\prod_{<b.trading\_license\_no,dish\_name>} branch\_serving \times \rho(\sigma_{trading\_license\_no}(branch) , b)) - \prod_{*} (branch\_serving)))$

ii) SQL DML:-

```
--1
select  distinct dish_name from branch_serving bs where dish_name not in (
	select dish_name from (
		select b.trading_license_no,dish_name from branch_serving bs2 cross join (select trading_license_no from branch ) as b
		except
		select * from branch_serving bs3
	) as r2
```

)

iii) Output:-



2) List all the employees of the Junagadh branch which are having more salary than average salary of all the employees of the Junagadh branch.

Ans-2)

i) Relational Algebra:-

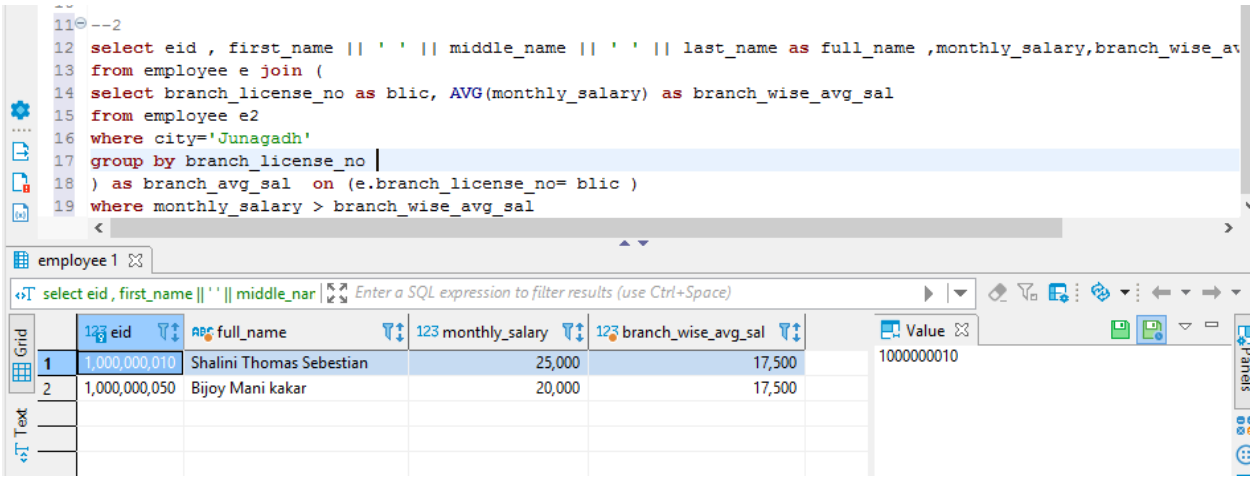
$\prod$ < eid , first_name || ' ' || middle_name || ' ' || last_name as full_name ,monthly_salary,branch_wise_avg_sal> σ<monthly_salary> branch_wise_avg_sal >(employee $\bowtie$ <e.branch_license_no= blic > ρ(branch_avg_sal , ($\prod$ <ρ(branch_license_no -> blic , AVG(monthly_salary) -> branch_wise_avg_sal)>σ<city='Junagadh'>

<branch_license_no> $\mathcal{F}$ < AVG(monthly_salary) > (employee))))

ii) SQL DML:-

```
select eid , first_name || ' ' || middle_name || ' ' || last_name as
full_name ,monthly_salary,branch_wise_avg_sal
from employee e join (
select branch_license_no as blic, AVG(monthly_salary) as
branch_wise_avg_sal
from employee e2
where city='Junagadh'
group by blic
) as branch_avg_sal  on (e.branch_license_no= blic )
where monthly_salary > branch_wise_avg_sal
```

iii) Output:-



3) List the branch details of the branch which has the lowest average salary for its employees.

Ans-3)

i) Relational Algebra:-

Branch $\bowtie$ <branch_license_no= r2.branch_license_no >ρ(r2, σ< branch_avg_sal = MIN(branch_avg_salary >(<branch_license_no> $\mathcal{F}$< ρ(AVG(monthly_salary)-->branch_avg_salary > (ρ(e,employee))

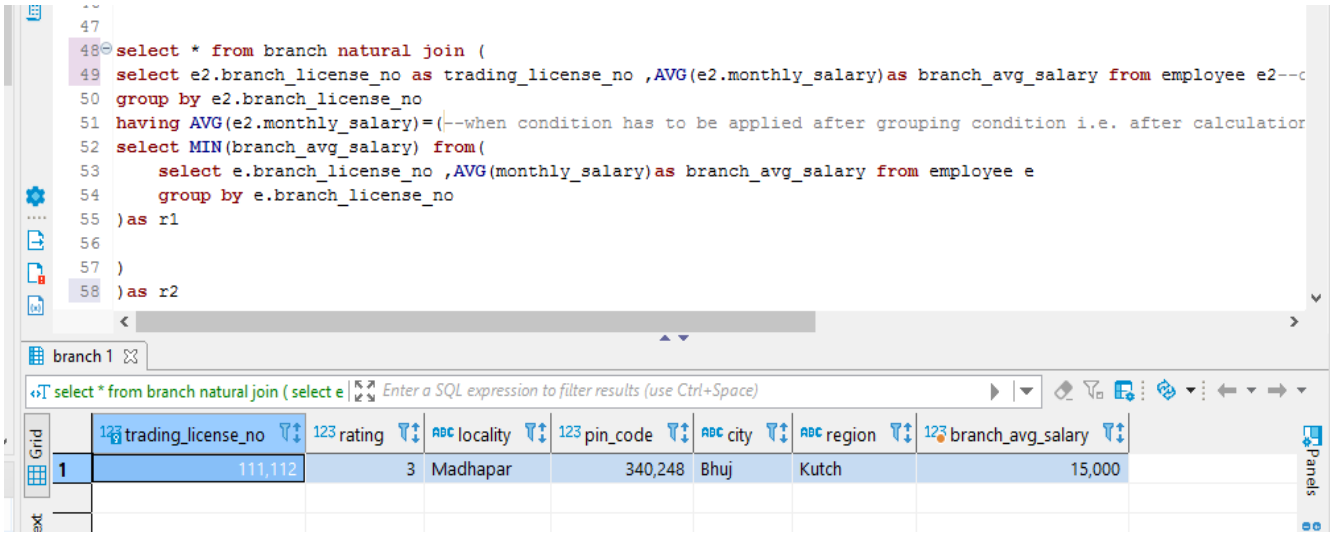
$\mathcal{F}$<MIN(branch_avg_salary) >(ρ(r1 ,(<branch_license_no> $\mathcal{F}$< ρ(AVG(monthly_salary)-->branch_avg_salary > (ρ(e,employee))))

ii) SQL DML:-

```
select * from branch natural join (
select e2.branch_license_no as trading_license_no
,AVG(e2.monthly_salary)as branch_avg_salary
from employee e2
group by e2.branch_license_no
having AVG(e2.monthly_salary) =
(
select MIN(branch_avg_salary) from
(
select e.branch_license_no ,AVG(monthly_salary)as
branch_avg_salary from employee e
group by e.branch_license_no
)as r1

)
)as r2
```

iii) Output:-



```
select * from branch natural join (
select e2.branch_license_no as trading_license_no ,AVG(e2.monthly_salary)as branch_avg_salary from employee e2--c
group by e2.branch_license_no
having AVG(e2.monthly_salary)=(--when condition has to be applied after grouping condition i.e. after calculatior
select MIN(branch_avg_salary) from(
    select e.branch_license_no ,AVG(monthly_salary)as branch_avg_salary from employee e
    group by e.branch_license_no
)as r1

)
)as r2
```

branch 1

select * from branch natural join (select e | Enter a SQL expression to filter results (use Ctrl+Space)

	trading_license_no	rating	locality	pin_code	city	region	branch_avg_salary
1	111,112	3	Madhapar	340,248	Bhuj	Kutch	15,000

4) List the most costly dish available in the Bhuj branch.

i) Relational Algebra:-

$\prod_{*}(dish)\ \sigma_{< price\ IN ><}(\ \rho(\ MAX\_SAL,\prod_{MAX(price)}(\ \prod_{<b.trading\_license\_no\ ,\ b.city\ ,\ bs.dish\_name\ ,\ d.price\ >}\ \sigma_{< b.city='Bhuj' >}(\rho(b,branch)\ \bowtie_{<b.trading\_license\_no=\ bs.branch\_no\ >}\ \rho(bs,branch\_serving)\ \bowtie_{<bs.dish\_name=d.dish\_name>}\ \rho(d\ ,\ dish\ )\ )\ )\ )\ )$

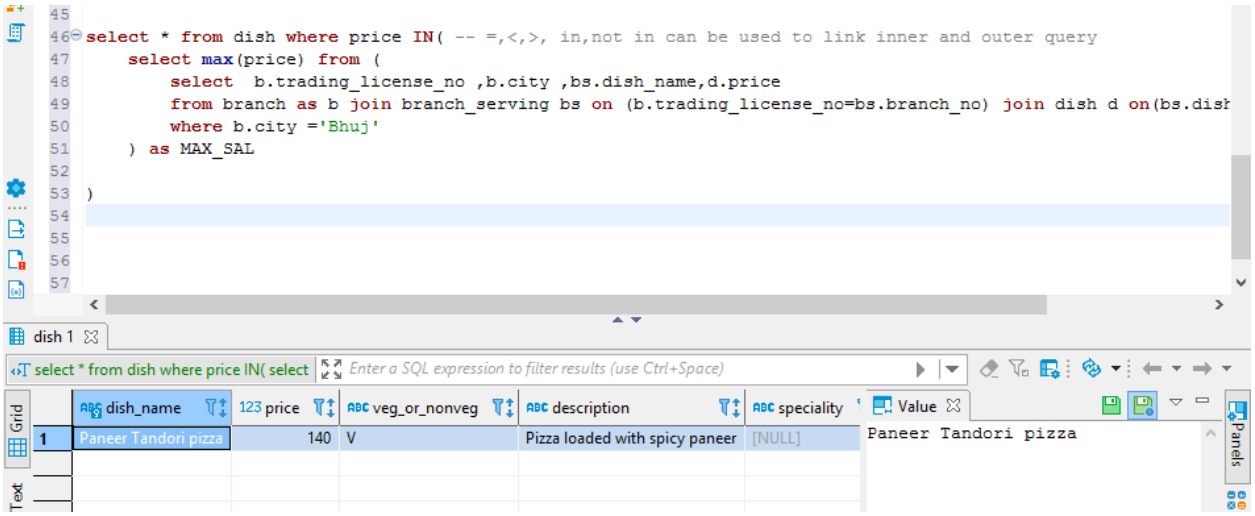
ii) SQL DML:-

```
-- =,<,>, in,not in can be used to link inner and outer query
select * from dish where price IN(
select max(price) from (
select  b.trading_license_no ,b.city ,bs.dish_name,d.price
```

from branch as b join branch_serving bs on (b.trading_license_no=bs.branch_no) join dish d on(bs.dish_name=d.dish_name)
where b.city ='Bhuj'
) as MAX_SAL

)

iii) Output:-



5) List all the employees of the company-owned branch whose overall performance is excellent and also salary is greater than average salary of their respective branches.

(Use of correlated query)

Ans-5)

i) Relational Algebra:-

$\prod_{<*>}\sigma_{<}$ e.company_employee =true AND e.overall_performance ='excellent' AND e.monthly_salary > $>$(ρ(e,employee) ($\prod_{<}$ AVG(monthly_salary) $>$($\sigma_{<}$ e2.branch_license_no=e..branch_license_no> ρ(e2 ,employee)))

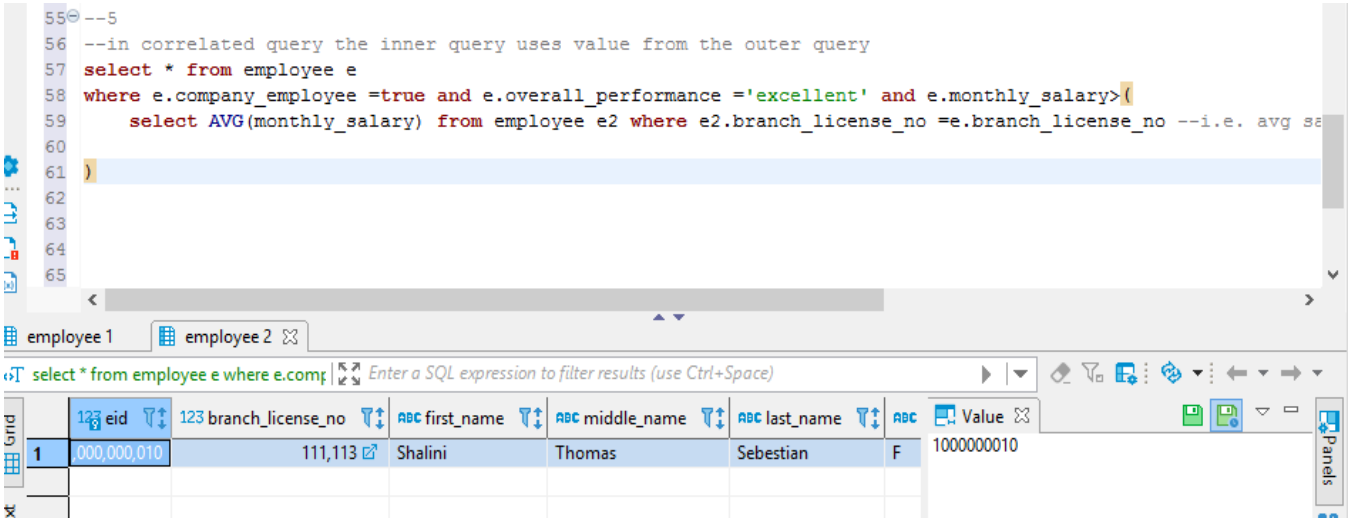
ii) SQL DML:-

--5

```
select * from employee e
where e.company_employee =true and
e.overall_performance ='excellent' and e.monthly_salary>(
        select AVG(monthly_salary) from employee e2 where
e2.branch_license_no =e.branch_license_no --i.e. avg salary
will be calculated of all the employees of the branch

)
```

iii) Output:-



6) List all the suppliers which supply all the raw materials.(division query)

Ans-6)

i) Relational Algebra:-

$\prod$ <r3.supplier_name,r3.supplier_office_locality,r3.supplier_office_city,contact_no>(
ρ(s3 ,supplier)

$\bowtie$<r3.supplier_name=s3.supplier_name,s3.office_locality,=r3.supplier_office_locality,s3.office_city=r3.supplier_office_city,>

ρ(r3 ,
$\prod$ <supplier_name,supplier_office_locality,supplier_office_city> (supplies)
-
ρ(r2,
$\prod$ <r1.supplier_name,r1.supplier_office_locality,r1.supplier_office_city>
ρ(r1, (
$\prod$ <s2.supplier_name,s2.supplier_office_locality,s2.supplier_office_city,rm.material_name >(ρ(s2 , supplier) X ρ(rm ,raw_material))
-
$\prod$ <supplier_name,supplier_office_locality,supplier_office_city,raw_material_name >(supplier)
)
)
)

ii) SQL DML:-

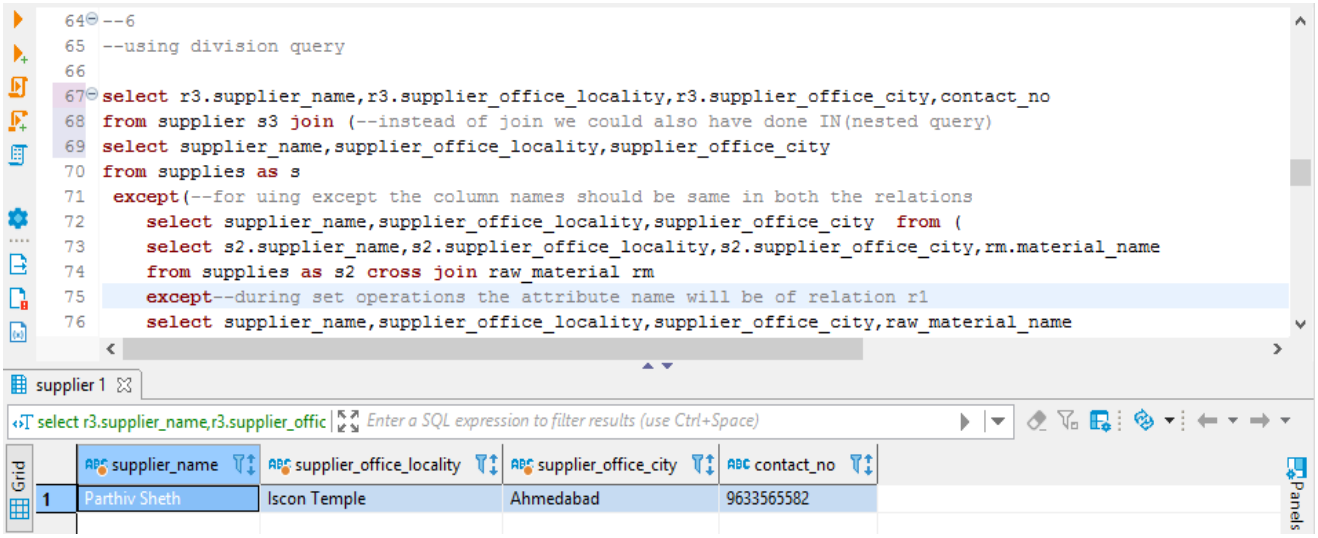
```
--6
--using division query

select
r3.supplier_name,r3.supplier_office_locality,r3.supplier_office_city,contact_no
```

```
from supplier s3 join (--instead of join we could also have
done IN(nested query)
select
supplier_name,supplier_office_locality,supplier_office_city
from supplies as s
 except(--for using except the column names should be same
in both the relations
        select
supplier_name,supplier_office_locality,supplier_office_city
from (
        select
s2.supplier_name,s2.supplier_office_locality,s2.supplier_offic
e_city,rm.material_name
        from supplies as s2 cross join raw_material rm
        except--during set operations the attribute name will be
of relation r1
        select
supplier_name,supplier_office_locality,supplier_office_city,ra
w_material_name
        from supplies
        ) as r2

  )
)as r3 on(s3.supplier_name=r3.supplier_name and
s3.office_locality=r3.supplier_office_locality and
s3.office_city=r3.supplier_office_city )
/*
```

iii) Output:-



```
64  --6
65  --using division query
66
67  select r3.supplier_name,r3.supplier_office_locality,r3.supplier_office_city,contact_no
68  from supplier s3 join (--instead of join we could also have done IN(nested query)
69  select supplier_name,supplier_office_locality,supplier_office_city
70  from supplies as s
71   except(--for uing except the column names should be same in both the relations
72      select supplier_name,supplier_office_locality,supplier_office_city  from (
73      select s2.supplier_name,s2.supplier_office_locality,s2.supplier_office_city,rm.material_name
74      from supplies as s2 cross join raw_material rm
75      except--during set operations the attribute name will be of relation r1
76      select supplier_name,supplier_office_locality,supplier_office_city,raw_material_name
```

supplier 1

select r3.supplier_name,r3.supplier_offic | Enter a SQL expression to filter results (use Ctrl+Space)

Grid

	supplier_name	supplier_office_locality	supplier_office_city	contact_no
1	Parthiv Sheth	Iscon Temple	Ahmedabad	9633565582

Panels

7) List the suppliers which supply the raw materials at the minimum cost relative to other suppliers which supply the same raw material.

Ans-7)

i) Relational Algebra:-

$\prod$ <supplier_name,supplier_office_locality,supplier_office_city , s.contact , r2.Minimum_available_cost >
(ρ(s , supplier) $\bowtie$< s.supplier_name=r2.supplier_name and s.office_locality=r2.supplier_office_locality and s.office_city=r2.supplier_office_city >
ρ(r2 ,
$\prod$ <supplier_name,supplier_office_locality,supplier_office_city , ρ((raw_material_name,cost)-->(Minimum_available_cost)(supplies)σ<(raw_material_name,cost) IN >(
< raw_material_name> $\mathcal{F}$< MIN(cost) >)
)

ii) SQL DML:-

--7

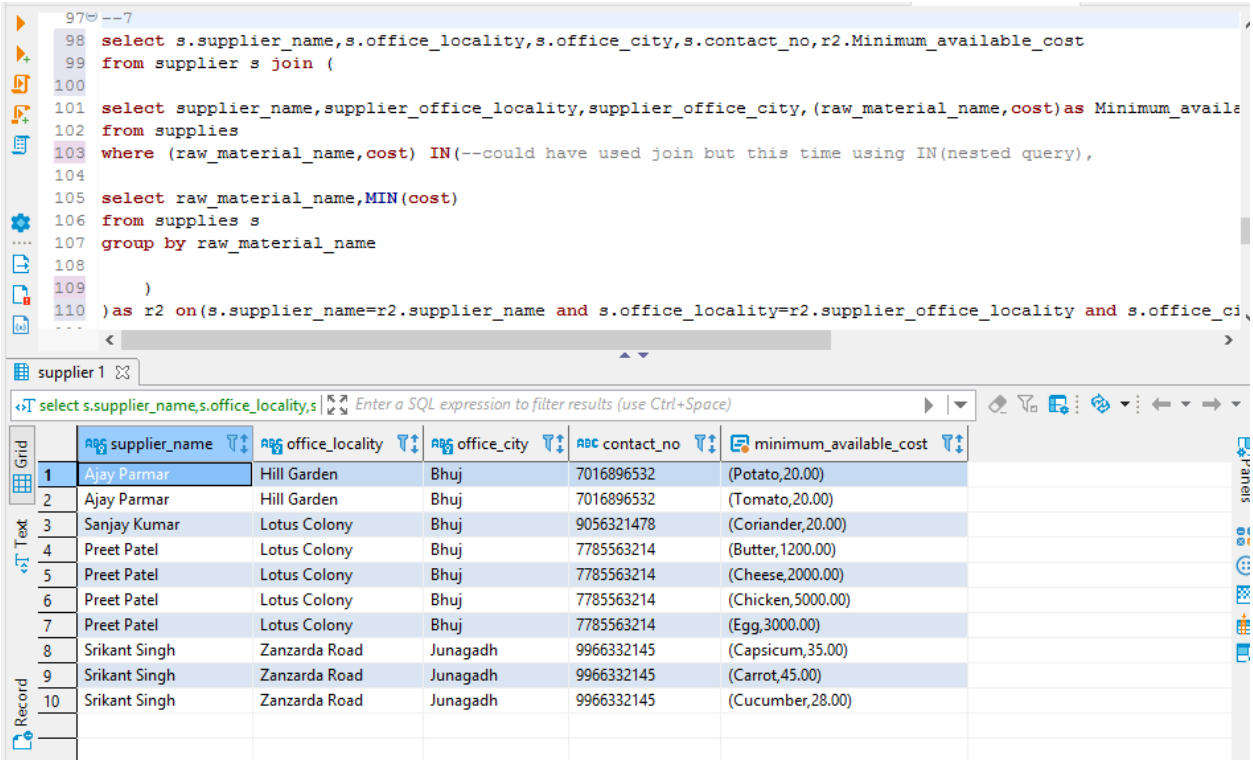
```
select
s.supplier_name,s.office_locality,s.office_city,s.contact_no,r2.
Minimum_available_cost
from supplier s join (

select
supplier_name,supplier_office_locality,supplier_office_city,(ra
w_material_name,cost)as Minimum_available_cost
from supplies
where (raw_material_name,cost) IN(

select raw_material_name,MIN(cost)
from supplies s
group by raw_material_name

        )
)as r2 on(s.supplier_name=r2.supplier_name and
s.office_locality=r2.supplier_office_locality and
s.office_city=r2.supplier_office_city )
```

iii) Output:-



```
97  --7
98  select s.supplier_name,s.office_locality,s.office_city,s.contact_no,r2.Minimum_available_cost
99  from supplier s join (
100
101 select supplier_name,supplier_office_locality,supplier_office_city,(raw_material_name,cost)as Minimum_availa
102 from supplies
103 where (raw_material_name,cost) IN(--could have used join but this time using IN(nested query),
104
105 select raw_material_name,MIN(cost)
106 from supplies s
107 group by raw_material_name
108
109     )
110 )as r2 on(s.supplier_name=r2.supplier_name and s.office_locality=r2.supplier_office_locality and s.office_ci
```

supplier 1

select s.supplier_name,s.office_locality,s | Enter a SQL expression to filter results (use Ctrl+Space)

Grid | Text | Record

	supplier_name	office_locality	office_city	contact_no	minimum_available_cost
1	Ajay Parmar	Hill Garden	Bhuj	7016896532	(Potato,20.00)
2	Ajay Parmar	Hill Garden	Bhuj	7016896532	(Tomato,20.00)
3	Sanjay Kumar	Lotus Colony	Bhuj	9056321478	(Coriander,20.00)
4	Preet Patel	Lotus Colony	Bhuj	7785563214	(Butter,1200.00)
5	Preet Patel	Lotus Colony	Bhuj	7785563214	(Cheese,2000.00)
6	Preet Patel	Lotus Colony	Bhuj	7785563214	(Chicken,5000.00)
7	Preet Patel	Lotus Colony	Bhuj	7785563214	(Egg,3000.00)
8	Srikant Singh	Zanzarda Road	Junagadh	9966332145	(Capsicum,35.00)
9	Srikant Singh	Zanzarda Road	Junagadh	9966332145	(Carrot,45.00)
10	Srikant Singh	Zanzarda Road	Junagadh	9966332145	(Cucumber,28.00)

8) List the company owned branch which spends the highest on advertisement.

Ans-8)

i) Relational Algebra:-

$\rho(b, branch) \bowtie_{<b.trading\_license\_no=trading\_license\_no>} \rho(r2, \sigma_{<expenditure\_on\_ad= MAX(expenditure\_on\_ad)>} \rho(r1, {}_{<trading\_license\_no>}\mathcal{F}_{<\rho(SUM(monthly\_charge)\text{--}> expenditure\_on\_ad>}(\rho(a, advertisement))($

$\mathcal{F}_{<MAX(expenditure\_on\_ad)>}({}_{<trading\_license\_no>}\mathcal{F}_{<\rho(SUM(monthly\_charge)\text{--}> expenditure\_on\_ad>}(\rho(a, advertisement)))))))$

ii) SQL DML:-

```
select * from branch b natural join (
select branch_no as
trading_license_no,SUM(monthly_charge) as
expenditure_on_ad
from advertisement a
group by trading_license_no
having SUM(monthly_charge)=(

select max(expenditure_on_ad) from (
select branch_no as
trading_license_no,SUM(monthly_charge) as
expenditure_on_ad
from advertisement a
group by trading_license_no
)as r1
)
)as r2
```

iii) Output:-

```
108
109 --8
110 select * from branch b natural join (
111 select branch_no as trading_license_no,SUM(monthly_charge) as expenditure_on_ad
112 from advertisement a
113 group by trading_license_no
114 having SUM(monthly_charge)=(--inner and outer query can be connected using =,>,<,in,not in
115
116 select max(expenditure_on_ad) from (
117 select branch_no as trading_license_no,SUM(monthly_charge) as expenditure_on_ad
118 from advertisement a
119 group by trading_license_no
120 )as r1
121 )
122 )as r2
```

branch 1

select * from branch b natural join (select | Enter a SQL expression to filter results (use Ctrl+Space)

Grid

	trading_license_no	rating	locality	pin_code	city	region	expenditure_on_ad
1	111,113	5	Zanzarda Road	340,246	Junagadh	Saurashtra	19,000

Text

9) List the Franchisee company which controls maximum no of branches.

Ans-9)

i) Relational Algebra:-

ρ(f , franchiseecompany)

$\bowtie_{<f.cin =r2.cin >}$

ρ(r2 ,

$\sigma_{<no\_of\_branches=max(no\_of\_branches) >}$

< cin > $\mathcal{F}_{<}$ ρ(COUNT(fob.trading_license_no) -->no_of_branches >ρ(fob, franchisee_owned_branch))

$\mathcal{F}_{<max(no\_of\_branches)>}$ (ρ(r1 ,

< cin > $\mathcal{F}_{<}$ ρ(COUNT(fob.trading_license_no) -->no_of_branches >ρ(fob, franchisee_owned_branch)))))

ii) SQL DML:-

```
  select * from franchiseecompany f natural join (
  select cin,COUNT(fob.trading_license_no)as
no_of_branches from franchisee_owned_branch fob
  group by cin
  having COUNT(fob.trading_license_no)=(

  select max(no_of_branches) from (
  select cin,COUNT(fob.trading_license_no)as
no_of_branches from franchisee_owned_branch fob
  group by cin
  )as r1
  )
  )as r2
```

iii) Output:-

```sql
--9
select * from franchiseecompany f natural join (
select cin,COUNT(fob.trading_license_no)as no_of_branches from franchisee_owned_branch fob
group by cin
having COUNT(fob.trading_license_no)=(

select max(no_of_branches) from (
select cin,COUNT(fob.trading_license_no)as no_of_branches from franchisee_owned_branch fob
group by cin
)as r1
)
)as r2
```

franchiseecompany 1

select * from franchiseecompany f natura | Enter a SQL expression to filter results (use Ctrl+Space)

	cin	company_name	head_manager	office_locality	office_pin_code	office_city	no_of_branches
1	L96576ZW1133IIT757693	Wayne Enterprises	Shreeji Joshi	SG Highway	340,200	Ahemdabad	1
2	L70167XY1122LNM777883	Globex Corporation	Aayush Kumar	Ghatgopal	400,004	Mumbai	1
3	U90167XY1111LNM777881	Acme Corporation	Aksat Srivastava	Bopal	340,200	Ahmedabad	1

10) List the monthly expenditure of each company-owned branch on raw materials.

Ans-10)

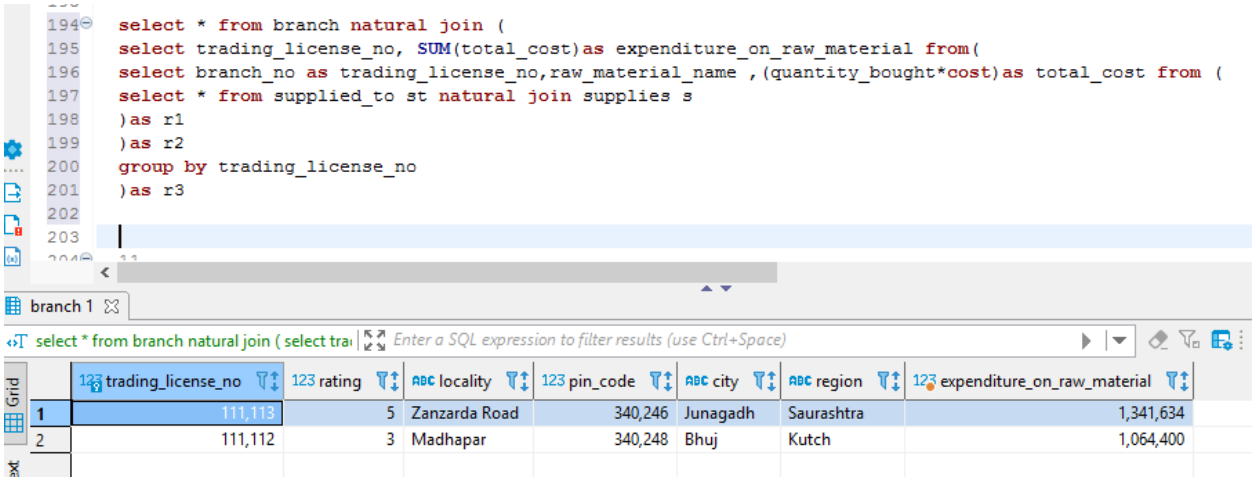
i) Relational Algebra:-

$\prod_{<*>}$ Branch $\bowtie_{<\ r3.trading\_license\_no=branch.trading\_license\_no\ >}$
$\rho($ r3 , (
$_{<trading\_license\_no>}\mathcal{F}\ \rho($ < SUM(total_cost) -> expenditure_on_raw_material >
$\rho($ r2 , $\prod$ < $\rho($ branch_no --> trading_license_no) , raw_material_name , $\rho($
(quantity_bought*cost)--> total_cost >$\rho($ r1 ,(
$\rho($ st ,supplied_to) $\bowtie_{<}$ st.supplier_name=s.supplier_name and
st.supplier_office_locality=s.supplier_office_locality and st.supplier_office_city=s.supplier_office_city
and st.raw_material_name=s.raw_material_name > $\rho($ s ,supplies)))))

ii) SQL DML:-

```
select * from branch natural join (
 select trading_license_no, SUM(total_cost)as
expenditure_on_raw_material from(
 select branch_no as trading_license_no,raw_material_name
,(quantity_bought*cost)as total_cost from (
 select * from supplied_to st natural join supplies s
 )as r1
 )as r2
 group by trading_license_no
 )as r3
```

iii) Output:-



11) List the contact details and other info of those franchisee companies which are controlling franchisee-owned branches which are paying royalty fees less than 60,000 per month.

Ans-11)

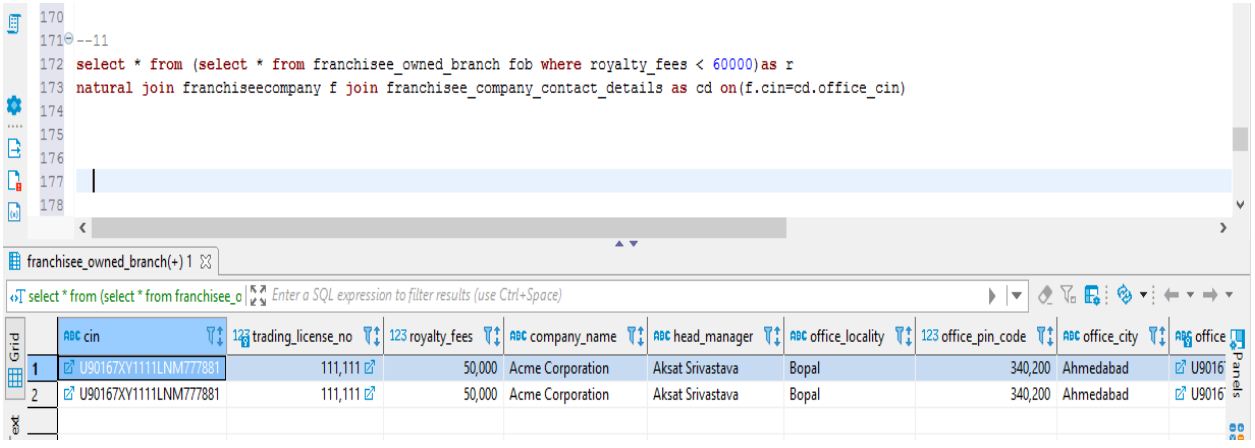
i) Relational Algebra:-

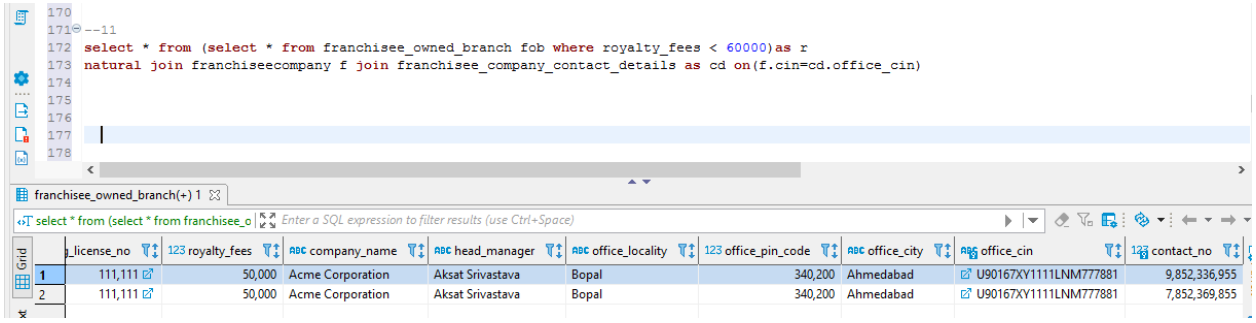
$\prod_{<*>}($
$\rho($ fc , franchiseecompany$) \bowtie_{<fc.cin=r,cin>} \rho($ r ,$(\prod_{<*>} \sigma_{<}$ royalty_fees $<$ 60000 $>}(\rho($ fob , franchisee_owned_branch$)))) \bowtie_{<fccd.cin=r,cin>} (\rho($ fccd , franchisee_company_contact_details$))$
$)$

ii) SQL DML:-

```
 --11
select * from (select * from franchisee_owned_branch fob
where royalty_fees < 60000)as r
natural join franchiseecompany f join
franchisee_company_contact_details as cd
on(f.cin=cd.office_cin)
 --natural join checks equality check btw common name
attributes
```

iii) Output:-





12) List the signature dishes of the branches in Saurashtra region.

Ans-12)

i) Relational Algebra:-

$\prod_{<*>} \sigma_{<\text{signature dish='true' AND region='Saurashtra''}>}(\text{dish})$

ii) SQL DML:-

select *from dish where signaturedish=true and region='Saurashtra'

iii) Output:-

```
176  --12
177  select *from dish where signaturedish=true and region='Saurashtra'
178
179
180
181
182
```

dish 1

select *from dish where signaturedish=tru | Enter a SQL expression to filter results (use Ctrl+Space)

	dish_name	price	veg_or_nonveg	description	speciality	region	signaturedish
1	Dry fruit kachori	100	V	Crispy and filled with stuff	Dry-fruit stuffing is filled	Saurashtra	[v]
2	Mango Pineapple Smoothie	125	V	Made with Kesar Mango	Made from seasonal Kesar mangoes	Saurashtra	[v]

13) List the branches with their most expensive signature dish(i.e. The signature dish which is the most expensive).

Ans-13)

i) Relational Algebra:-

$$\prod_{<*>}\rho(\text{b.branch}) \bowtie_{<\text{b.trading\_license\_no=r3.trading\_license\_no}>} \rho(\text{r3}, \prod_{<\text{trading\_license\_no,d.dish\_name,d.price}>}(\rho(\text{d,dish}) \bowtie_{<\text{r2.max\_price=d.price AND d.signaturedish=true}>}$$

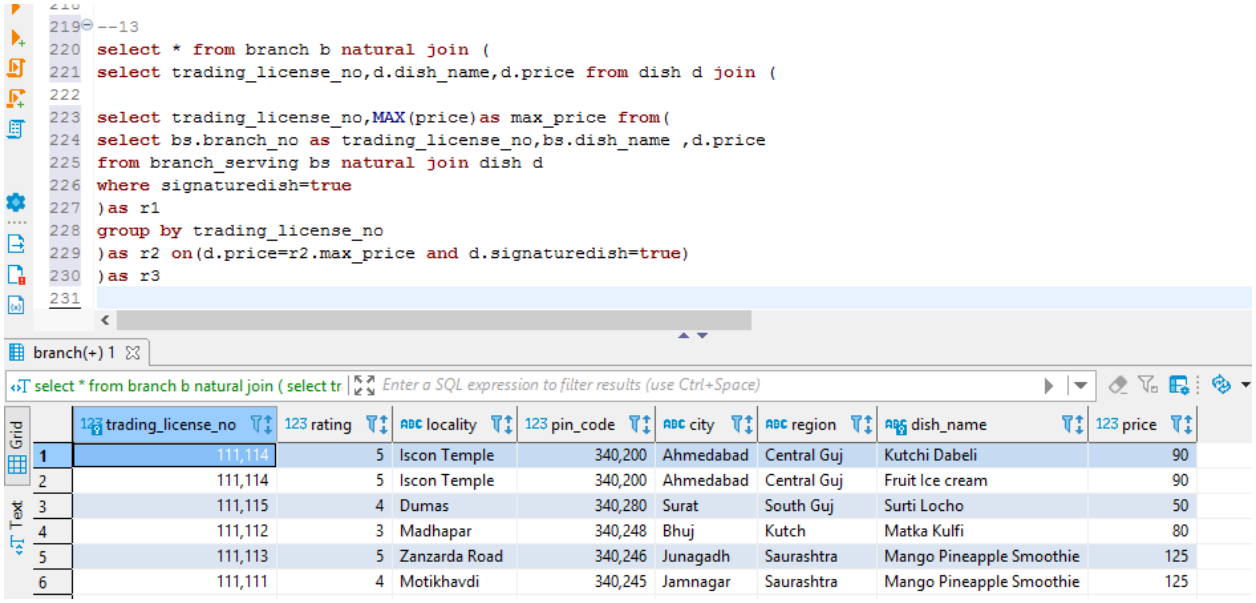
$$\rho(\text{r2}, {}_{<\text{trading\_license\_no}>}\mathcal{F}_{<\rho(\text{MAX(price)}\dashrightarrow \text{max\_price})>}\rho(\text{r1}, \prod_{<\rho(\text{bs.branch\_no} \dashrightarrow \text{trading\_license\_no}),\text{bs.dish\_name},\text{d.price}>}(\rho(\text{bs,branch\_serving}) \bowtie_{<\text{bs.dish\_name=d.dish\_name}>} \rho(\text{d,dish}))))))$$

ii) SQL DML:-

```
select * from branch b natural join (
select trading_license_no,d.dish_name,d.price from dish d
join (

select trading_license_no,MAX(price)as max_price from(
select bs.branch_no as trading_license_no,bs.dish_name
,d.price
from branch_serving bs natural join dish d
where signaturedish=true
)as r1
group by trading_license_no
)as r2 on(d.price=r2.max_price and d.signaturedish=true)
)as r3
```

iii) Output:-



```
219 --13
220 select * from branch b natural join (
221 select trading_license_no,d.dish_name,d.price from dish d join (
222
223 select trading_license_no,MAX(price)as max_price from(
224 select bs.branch_no as trading_license_no,bs.dish_name ,d.price
225 from branch_serving bs natural join dish d
226 where signaturedish=true
227 )as r1
228 group by trading_license_no
229 )as r2 on(d.price=r2.max_price and d.signaturedish=true)
230 )as r3
231
```

branch(+) 1

select * from branch b natural join (select tr | Enter a SQL expression to filter results (use Ctrl+Space)

Grid | Text

	trading_license_no	rating	locality	pin_code	city	region	dish_name	price
1	111,114	5	Iscon Temple	340,200	Ahmedabad	Central Guj	Kutchi Dabeli	90
2	111,114	5	Iscon Temple	340,200	Ahmedabad	Central Guj	Fruit Ice cream	90
3	111,115	4	Dumas	340,280	Surat	South Guj	Surti Locho	50
4	111,112	3	Madhapar	340,248	Bhuj	Kutch	Matka Kulfi	80
5	111,113	5	Zanzarda Road	340,246	Junagadh	Saurashtra	Mango Pineapple Smoothie	125
6	111,111	4	Motikhavdi	340,245	Jamnagar	Saurashtra	Mango Pineapple Smoothie	125

14) List all the franchisee companies and the number of branches that each franchisee company controls and the

total amount of royalty fees that each company has to pay to the franchisor.

Ans-14)

i) Relational Algebra:-

$\prod_{<*>}$(

ρ(fc ,franchisee company) $\bowtie_{< fc.cin = r1.cin >}$

ρ(r1, $_{< CIN >}\mathcal{F}_{< COUNT(trading\_license\_no) , SUM(royalty\_fees) >}$(franchisee_owned_branch))

)

ii) SQL DML:-

```
 select f.cin ,f.company_name ,f.office_locality ,f.office_city
,no_of_branches_controlled,total_fees_paid_to_franchisor
 from franchiseecompany f natural join(
        select cin,COUNT(trading_license_no)as
no_of_branches_controlled,SUM(royalty_fees)as
total_fees_paid_to_franchisor
        from franchisee_owned_branch fob
        group by cin
)as r1
```

iii) Output:-

```
267
268 select f.cin ,f.company_name ,f.office_locality ,f.office_city ,no_of_branches_controlled,total_fees_paid_to_franchiso
269 from franchiseecompany f natural join(
270    select cin,COUNT(trading_license_no)as no_of_branches_controlled,SUM(royalty_fees)as total_fees_paid_to_franchisor
271    from franchisee_owned_branch fob
272    group by cin
273 )as r1
274
275
```

franchiseecompany 1

select f.cin ,f.company_name ,f.office_locali | Enter a SQL expression to filter results (use Ctrl+Space)

	cin	company_name	office_locality	office_city	no_of_branches_controlled	total_fees_paid_to_franchisor
1	L96576ZW1133IIT757693	Wayne Enterprises	SG Highway	Ahemdabad	1	90,000
2	L70167XY1122LNM777883	Globex Corporation	Ghatgopal	Mumbai	1	70,000
3	U90167XY1111LNM777881	Acme Corporation	Bopal	Ahmedabad	1	50,000

15) List the suppliers which supply different raw materials in the Bhuj branch , the monthly amount(in kg) and the price(in Rs) at which they supply these raw materials to the branch.

Ans-15)

i) Relational Algebra:-

$\prod$ < * , ρ((r2.quantity_bought*s.cost)--> total_monthly_expenditure)>
ρ(r1 , $\prod$ <b.trading_license_no ,b.locality ,b.city>σ< b.city='Bhuj' > (ρ(b , branch) $\bowtie$<b.trading_license_no=cob.trading_license_no > ρ(cob , company_owned_branch))) $\bowtie$<b.trading_license_no=st.branch_no >ρ(st, supplied_to) $\bowtie$< r1.trading_license=s.trading_license AND r1.raw_materail_name= s.raw_materail_name ρ(s ,supplies)

ii) SQL DML:-

```
select *,(r2.quantity_bought*s.cost)as
total_monthly_expenditure from(
select st.* from (select b.trading_license_no ,b.locality ,b.city
from branch b natural join company_owned_branch cob
where b.city='Bhuj')as r1 join supplied_to st
on(r1.trading_license_no=st.branch_no)
)as r2 natural join supplies s
```

iii) Output:-

```
select *,(r2.quantity_bought*s.cost)as total_monthly_expenditure from(
select st.* from (select b.trading_license_no ,b.locality ,b.city from branch b natural join company_owned_branch cob
where b.city='Bhuj')as r1 join supplied_to st on(r1.trading_license_no=st.branch_no)
)as r2 natural join supplies s
```

supplied_to(+) 1

select *,(r2.quantity_bought*s.cost)as total_r | Enter a SQL expression to filter results (use Ctrl+Space)

	supplier_name	supplier_office_locality	supplier_office_city	raw_material_name	branch_no	quantity_bought	cost	total_monthly_expenditure
1	Ajay Parmar	Hill Garden	Bhuj	Potato	111,112	300	20	6,000
2	Sanjay Kumar	Lotus Colony	Bhuj	Tomato	111,112	200	30	6,000
3	Ajay Parmar	Hill Garden	Bhuj	Capsicum	111,112	250	40	10,000
4	Sanjay Kumar	Lotus Colony	Bhuj	Coriander	111,112	20	20	400
5	Ajay Parmar	Hill Garden	Bhuj	Carrot	111,112	150	50	7,500
6	Ajay Parmar	Hill Garden	Bhuj	Cucumber	111,112	150	30	4,500
7	Preet Patel	Lotus Colony	Bhuj	Butter	111,112	200	1,200	240,000
8	Preet Patel	Lotus Colony	Bhuj	Cheese	111,112	300	2,000	600,000
9	Preet Patel	Lotus Colony	Bhuj	Chicken	111,112	20	5,000	100,000
10	Preet Patel	Lotus Colony	Bhuj	Egg	111,112	30	3,000	90,000

16) List all the company-owned branches and the respective profit made by each of the branches by mentioning monthly expenditure(any month in 2020) on raw materials , tax , advertisements and the revenue generated and then finally mentioning the profit made by that branch.

Ans16)

i) Relational Algebra:-

$\rho(b, branch) \bowtie_{< b.trading\_license\_no = r6.trading\_license\_no>}$

$\rho(r6 ,$

$\bowtie_{<b.trading\_license\_no=r6.\ trading\_license\_no>}$

$\rho(r3, < \rho(trading\_license\_no \rightarrow branch\_no > \mathcal{F}_{<\rho(SUM(a.monthly\_charge) \rightarrow expenditure\_on\_advertisement >} (\rho(a ,advertisement))$

$\bowtie_{<r3.trading\_license\_no=r4.trading\_license\_no >} \rho(r4 , \prod_{< bs.trading\_license\_no , bs.expenditure\_on\_tax >} (\sigma_{<year=2020>}(\rho(bs ,branch\_statistics)))$

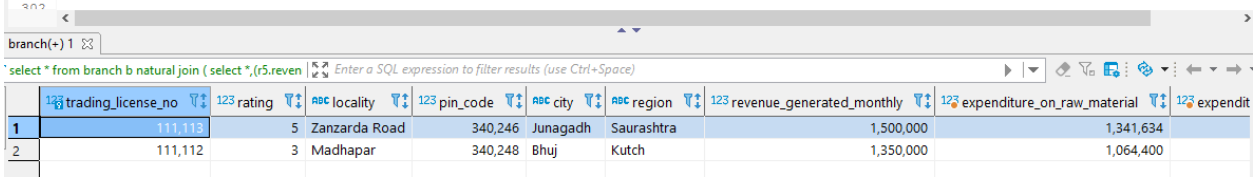
)

ii) SQL DML:-

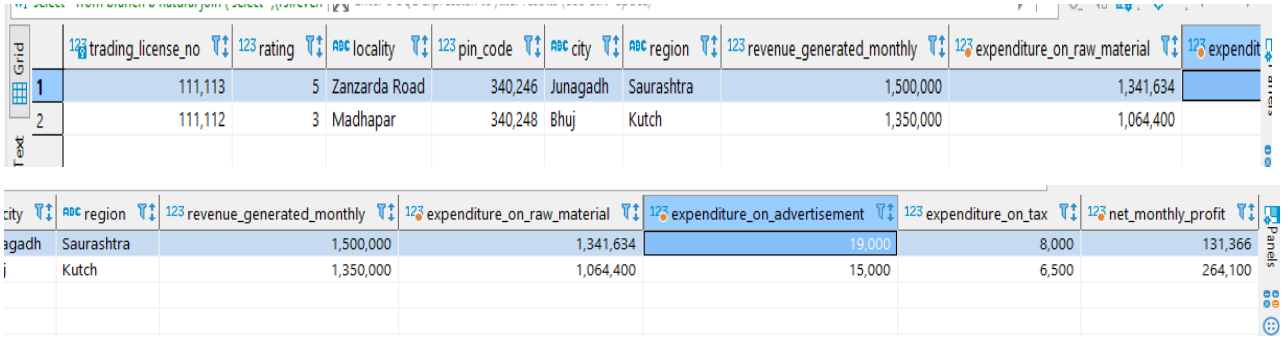
```
select * from branch b natural join (
select
*,(r5.revenue_generated_monthly-r5.expenditure_on_raw_m
aterial-r5.expenditure_on_advertisement-r5.expenditure_on_t
ax)as net_monthly_profit  from (
select * from company_owned_branch cob natural join (
select branch_no as trading_license_no,SUM(total_cost)as
expenditure_on_raw_material from(
select *,(st.quantity_bought*s.cost)as total_cost from
supplied_to st natural join supplies s
)as r1
group by trading_license_no
)as r2 natural join (
select a.branch_no as
trading_license_no,SUM(a.monthly_charge) as
expenditure_on_advertisement
from advertisement a
group by trading_license_no
)as r3
natural join (
select bs.trading_license_no,bs.expenditure_on_tax from
branch_statistics bs
where year=2020
)as r4
)as r5
)as r6
```

iii) Output:-

```
-----16
select * from branch b natural join (
select *,(r5.revenue_generated_monthly-r5.expenditure_on_raw_material-r5.expenditure_on_advertisement-r5.expenditure_on_tax)as net_monthly_pr
select * from company_owned_branch cob natural join (
select branch_no as trading_license_no,SUM(total_cost)as expenditure_on_raw_material from(
select *,(st.quantity_bought*s.cost)as total_cost from supplied_to st natural join supplies s
)as r1
group by trading_license_no  --natural join is for equality check btw common named attributes
)as r2 natural join (
select a.branch_no as trading_license_no,SUM(a.monthly_charge) as expenditure_on_advertisement
from advertisement a
group by trading_license_no
)as r3
natural join (
select bs.trading_license_no,bs.expenditure_on_tax from branch_statistics bs
where year=2020
)as r4
)as r5
)as r6
```



	trading_license_no	rating	locality	pin_code	city	region	revenue_generated_monthly	expenditure_on_raw_material	expendit
1	111,113	5	Zanzarda Road	340,246	Junagadh	Saurashtra	1,500,000	1,341,634	
2	111,112	3	Madhapar	340,248	Bhuj	Kutch	1,350,000	1,064,400	



	trading_license_no	rating	locality	pin_code	city	region	revenue_generated_monthly	expenditure_on_raw_material	expendit
1	111,113	5	Zanzarda Road	340,246	Junagadh	Saurashtra	1,500,000	1,341,634	
2	111,112	3	Madhapar	340,248	Bhuj	Kutch	1,350,000	1,064,400	

city	region	revenue_generated_monthly	expenditure_on_raw_material	expenditure_on_advertisement	expenditure_on_tax	net_monthly_profit
agadh	Saurashtra	1,500,000	1,341,634	19,000	8,000	131,366
j	Kutch	1,350,000	1,064,400	15,000	6,500	264,100

17) List the name , salary , branch details , contact no of all the employees who have more than 2 dependents

Ans-17)

i) Relational Algebra:-

$\rho(b , branch) \bowtie_{< b.trading\_license\_no= r2.trading\_license\_no >}$

$\rho(r2 ,$

$\prod_{< name , monthly\_salary , \rho(branch\_license\_no \rightarrow trading\_license\_no , contact\_no >}(\rho(e ,employee) \bowtie_{< e.eid = r.employee\_eid >} {}_{< employee\_eid >} \mathcal{F}_{< COUNT(*) >} \sigma_{< no\_of\_dependents > 2 >}(\rho(d , dependents))$

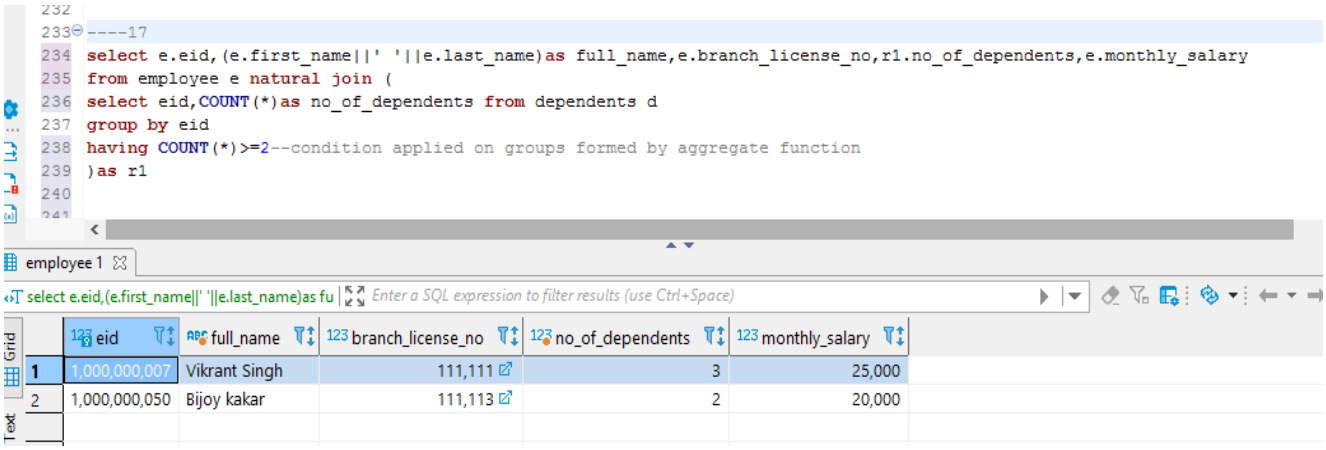
$\rho(s3 ,supplier) \bowtie_{<r3 >}$

)

ii) SQL DML:-

```
select e.eid,(e.first_name||' '||e.last_name)as
full_name,e.branch_license_no,r1.no_of_dependents,e.mont
hly_salary
from employee e natural join (
select eid,COUNT(*)as no_of_dependents from dependents
d
group by eid
having COUNT(*)>=2--condition applied on groups formed by
aggregate function
)as r1
```

iii) Output:-



18) List the name , salary , branch license no , locality and city where he/she lives , gender, contact details , and number of dependents , city and locality of the employee whose salary is in the range of 15,000 to 20,000 and their first name is having ‘a’ or ‘e’ at any position and they have worked for at least 2 years .

Ans-18)

i) Relational Algebra:-

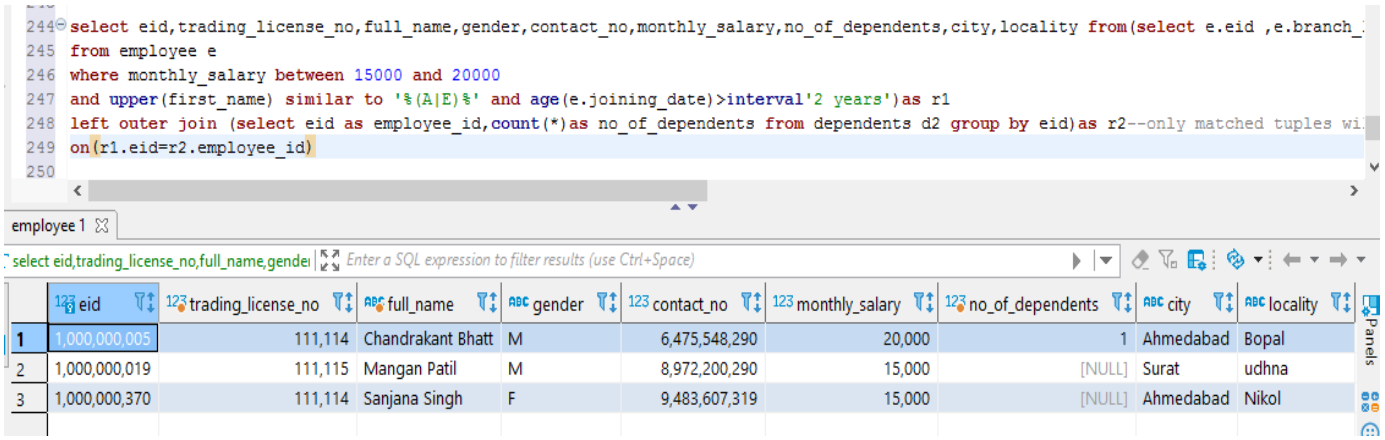
Π < name ,monthly_salary , branch license no , locality ,city, gender, contact details, no_of_dependents >

$\sigma_{<}$ monthly_salary between 15000 and 20000 AND upper(first_name) similar to ' %(A|E)%' AND age(e.joining_date)> interval ' 2 years' $>\rho($ e ,employee) $\bowtie_{<}$ e.eid=r.employee_eid > < employee_eid > $\mathcal{F}_{<}$ COUNT(*) $>\rho($ r ,dependents)

ii) SQL DML:-

```
select
eid,trading_license_no,full_name,gender,contact_no,monthly
_salary,no_of_dependents,city,locality from(select e.eid
,e.branch_license_no as trading_license_no,(e.first_name ||'
'||e.last_name)as
full_name,e.gender,e.contact_no,e.monthly_salary,e.city,e.loc
ality
from employee e
where monthly_salary between 15000 and 20000
and upper(first_name) similar to '%(A|E)%' and
age(e.joining_date)>interval'2 years')as r1
left outer join (select eid as employee_id,count(*)as
no_of_dependents from dependents d2 group by eid)as r2
on(r1.eid=r2.employee_id)
```

iii) Output:-



19) List all the company employees who have worked for at least 2 years and their salary is less than average salary of all the company employees.

Ans-19)

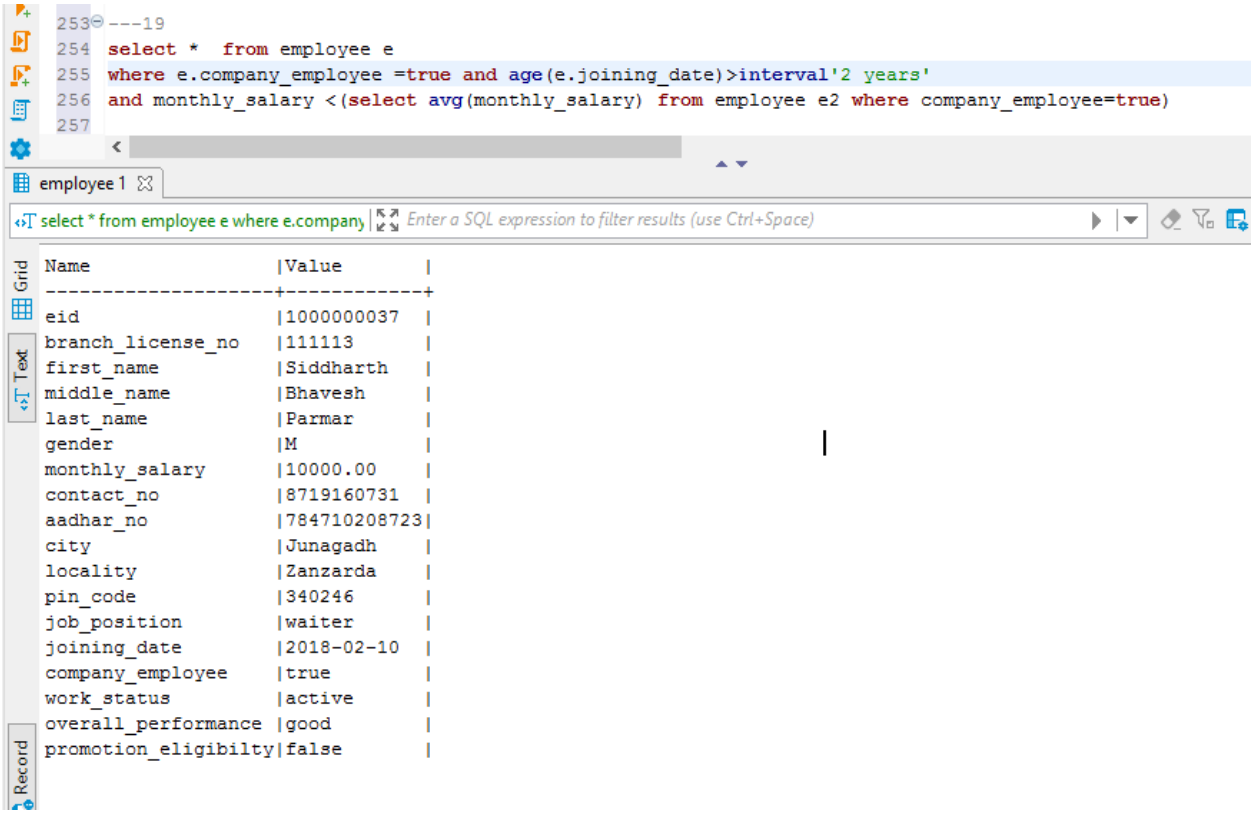
i) Relational Algebra:-

σ< e.company_employee =true AND age(e.joining_date) > interval '2 years' AND monthly_salary< AVG(monthly_salary) > ρ(e ,employee) $\mathcal{F}$< AVG(monthly_salary) >

ii) SQL DML:-

```
select *  from employee e
where e.company_employee =true and
age(e.joining_date)>interval'2 years'
and monthly_salary <(select avg(monthly_salary) from
employee e2 where company_employee=true)
```

iii) Output:-



```
253 ---19
254 select *  from employee e
255 where e.company_employee =true and age(e.joining_date)>interval'2 years'
256 and monthly_salary <(select avg(monthly_salary) from employee e2 where company_employee=true)
257
```

employee 1

select * from employee e where e.company | Enter a SQL expression to filter results (use Ctrl+Space)

Grid | Text | Record

Name	Value
eid	1000000037
branch_license_no	111113
first_name	Siddharth
middle_name	Bhavesh
last_name	Parmar
gender	M
monthly_salary	10000.00
contact_no	8719160731
aadhar_no	784710208723
city	Junagadh
locality	Zanzarda
pin_code	340246
job_position	waiter
joining_date	2018-02-10
company_employee	true
work_status	active
overall_performance	good
promotion_eligibilty	false

20) Give the company-owned branch details alongwith the dish name which has been the “most selling dish” for maximum no of times for that particular branch.

Ans-20)

i) Relational Algebra:-

$\prod$ <r3.supplier_no>(
ρ(s3 ,supplier) $\bowtie$ <r3 >
σ < e.co >
$\mathcal{F}$ < AVG(monthly_salary) >

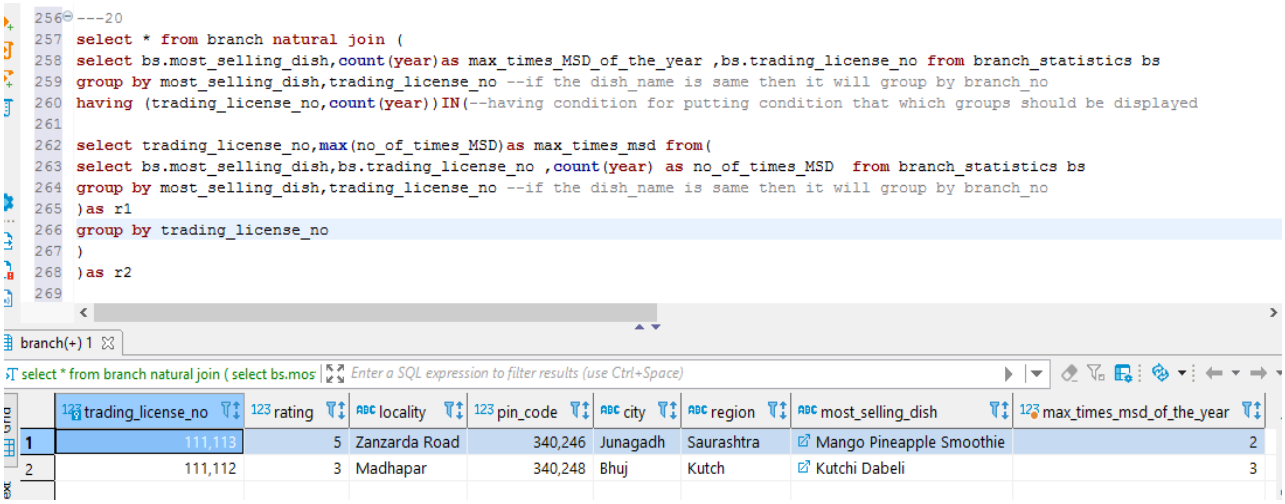
ii) SQL DML:-

select * from branch natural join (

```
select bs.most_selling_dish,count(year)as
max_times_MSD_of_the_year ,bs.trading_license_no from
branch_statistics bs
group by most_selling_dish,trading_license_no
having (trading_license_no,count(year))IN(

select trading_license_no,max(no_of_times_MSD)as
max_times_msd from(
select bs.most_selling_dish,bs.trading_license_no
,count(year) as no_of_times_MSD  from branch_statistics bs
group by most_selling_dish,trading_license_no
)as r1
group by trading_license_no
)
)as r2
```

iii) Output:-

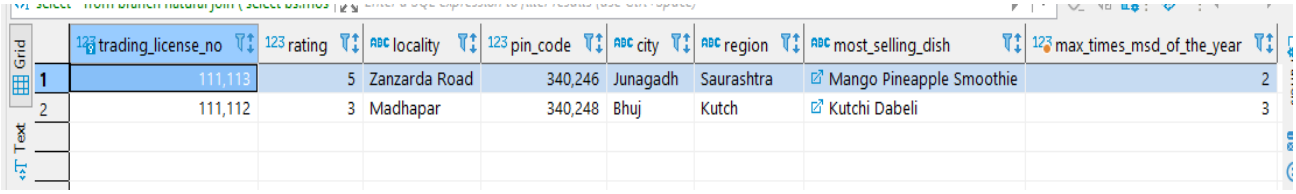


```
256 ---20
257 select * from branch natural join (
258 select bs.most_selling_dish,count(year)as max_times_MSD_of_the_year ,bs.trading_license_no from branch_statistics bs
259 group by most_selling_dish,trading_license_no --if the dish_name is same then it will group by branch_no
260 having (trading_license_no,count(year))IN(--having condition for putting condition that which groups should be displayed
261
262 select trading_license_no,max(no_of_times_MSD)as max_times_msd from(
263 select bs.most_selling_dish,bs.trading_license_no ,count(year) as no_of_times_MSD  from branch_statistics bs
264 group by most_selling_dish,trading_license_no --if the dish_name is same then it will group by branch_no
265 )as r1
266 group by trading_license_no
267 )
268 )as r2
269
```

branch(+) 1

select * from branch natural join (select bs.mos | Enter a SQL expression to filter results (use Ctrl+Space)

	trading_license_no	rating	locality	pin_code	city	region	most_selling_dish	max_times_msd_of_the_year
1	111,113	5	Zanzarda Road	340,246	Junagadh	Saurashtra	Mango Pineapple Smoothie	2
2	111,112	3	Madhapar	340,248	Bhuj	Kutch	Kutchi Dabeli	3



	trading_license_no	rating	locality	pin_code	city	region	most_selling_dish	max_times_msd_of_the_year
1	111,113	5	Zanzarda Road	340,246	Junagadh	Saurashtra	Mango Pineapple Smoothie	2
2	111,112	3	Madhapar	340,248	Bhuj	Kutch	Kutchi Dabeli	3

21) List the branch details of those branches having at least 3 employees in branch

Ans-21)

i) Relational Algebra:-

$\rho(\ b\ ,branch\ ) \bowtie_{<b.trading\_license\_no\ =\ branch\_license\_no\ >}$

$\sigma_{<\ COUNT(eid)\ >=\ 3\ >}(_{<branch\_license\_no>}\mathcal{F}_{<\ COUNT(eid)>})$

ii) SQL DML:-

```
select * from branch b natural join(
select  e.branch_license_no as trading_license_no
,COUNT(eid)as no_of_employees from employee e
group by e.branch_license_no
having COUNT(eid)>=3
)as r1
```

iii) Output:-

```
273 select * from branch b natural join(
274 select  e.branch_license_no as trading_license_no ,COUNT(eid)as no_of_employees from employee e
275 group by e.branch_license_no
276 having COUNT(eid)>=3
277 )as r1
278
```

branch 1

select * from branch b natural join(select e.brar | Enter a SQL expression to filter results (use Ctrl+Space)

	trading_license_no	rating	locality	pin_code	city	region	no_of_employees
1	111,113	5	Zanzarda Road	340,246	Junagadh	Saurashtra	4
2	111,114	5	Iscon Temple	340,200	Ahmedabad	Central Guj	4
3	111,115	4	Dumas	340,280	Surat	South Guj	4