CS122A HW7
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1.
```
SELECT cid, email, flight_number, projected_departure_datetime,
quantity

FROM Customer NATURAL JOIN Customer_Reserves_Flight

WHERE email LIKE 'i%'
```


2.
```
SELECT cid, email, flight_number, projected_departure_datetime,
quantity

FROM Customer NATURAL JOIN Customer_Reserves_Flight

WHERE email LIKE '%d.com'
```


3.
```
SELECT cid, email, flight_number, projected_departure_datetime,
quantity

FROM Customer NATURAL JOIN Customer_Reserves_Flight

WHERE projected_departure_datetime <= STR_TO_DATE('2015-07-01
00:00:00', '%Y-%m-%d %H:%i:%s')
```


4.
a.
Execute:
```
> EXPLAIN SELECT cid, email, flight_number,
projected_departure_datetime, quantity
FROM Customer NATURAL JOIN Customer_Reserves_Flight
WHERE email LIKE 'i%'
```

```
+ ------- + -------------- + --------- + -------------- +
--------- + ---------------- + ------- + ----------- +
-------- + -------- + ------------ + --------- +
| id      | select_type    | table     | partitions     |
type      | possible_keys    | key      | key_len      | ref
| rows      | filtered      | Extra         |
+ ------- + -------------- + --------- + -------------- +
--------- + ---------------- + ------- + ----------- +
-------- + -------- + ------------ + --------- +
| 1       | SIMPLE         | Customer  |                          | ALL
| PRIMARY              |           |                  |            | 20
| 11.11         | Using where |
| 1       | SIMPLE         | Customer_Reserves_Flight |
| ALL       | PRIMARY          |           |                  |
| 25        | 100.00         | Using where; Using join buffer
(Block Nested Loop) |
+ ------- + -------------- + --------- + -------------- +
--------- + ---------------- + ------- + ----------- +
-------- + -------- + ------------ + --------- +
2 rows
```

b.
Execute:
> EXPLAIN SELECT cid, email, flight_number,
projected_departure_datetime, quantity
FROM Customer NATURAL JOIN Customer_Reserves_Flight
WHERE email LIKE '%d.com'

```
+ ------- + -------------- + --------- + -------------- +
--------- + ---------------- + ------- + ----------- +
-------- + -------- + ------------ + --------- +
| id      | select_type    | table     | partitions     |
type      | possible_keys    | key      | key_len      | ref
| rows      | filtered      | Extra         |
+ ------- + -------------- + --------- + -------------- +
--------- + ---------------- + ------- + ----------- +
```

```
-------- + --------- + ------------ + --------- +
| 1        | SIMPLE          | Customer    |                    | ALL
| PRIMARY          |            |                |             | 20
| 11.11       | Using where |

| 1        | SIMPLE          | Customer_Reserves_Flight |
| ALL      | PRIMARY         |            |                |          |
| 25       | 100.00       | Using where; Using join buffer
(Block Nested Loop) |

+ ------- + -------------- + --------- + -------------- +
--------- + ---------------- + ------- + ----------- +
-------- + --------- + ------------ + --------- +
```

2 rows

c.
Execute:

> EXPLAIN SELECT cid, email, flight_number,
projected_departure_datetime, quantity

FROM Customer NATURAL JOIN Customer_Reserves_Flight

WHERE projected_departure_datetime <= STR_TO_DATE('2015-07-01
00:00:00', '%Y-%m-%d %H:%i:%s')

```
+ ------- + -------------- + --------- + -------------- +
--------- + ---------------- + ------- + ----------- +
-------- + --------- + ------------ + --------- +
| id       | select_type     | table      | partitions     |
type      | possible_keys   | key      | key_len     | ref
| rows     | filtered     | Extra       |
+ ------- + -------------- + --------- + -------------- +
--------- + ---------------- + ------- + ----------- +
-------- + --------- + ------------ + --------- +
| 1        | SIMPLE          | Customer_Reserves_Flight |
| ALL      | PRIMARY         |            |                |          |
| 25       | 33.33        | Using where |
| 1        | SIMPLE          | Customer    |                    |
```

```
eq_ref    | PRIMARY              | PRIMARY | 4             |
cs122a.Customer_Reserves_Flight.cid | 1       | 100.00
|           |
```

```
+ ------- + --------------- + --------- + ------------- +
-------- + --------------- + ------- + ----------- +
-------- + -------- + ------------ + --------- +
```

2 rows

5.

```
CREATE INDEX ix_Customer_email
ON Customer(email)
```


6.

```
CREATE INDEX ix_CRF_projected_departure_datetime
ON Customer_Reserves_Flight(projected_departure_datetime)
```


7.

a.

Execute:

```
> EXPLAIN SELECT cid, email, flight_number,
projected_departure_datetime, quantity
FROM Customer NATURAL JOIN Customer_Reserves_Flight
WHERE email LIKE 'i%'
```


```
+ ------- + --------------- + --------- + -------------- +
--------- + --------------- + ------- + ----------- +
-------- + -------- + ------------ + --------- +
| id      | select_type     | table     | partitions     |
type     | possible_keys   | key     | key_len     | ref
| rows    | filtered      | Extra       |
+ ------- + --------------- + --------- + -------------- +
--------- + --------------- + ------- + ----------- +
-------- + -------- + ------------ + --------- +
| 1       | SIMPLE          | Customer  |              |
```

```
range       | PRIMARY,ix_Customer_email | ix_Customer_email | 93
|           | 3            | 100.00           | Using where; Using index
|

| 1         | SIMPLE                  | Customer_Reserves_Flight |
| ref       | PRIMARY                 | PRIMARY | 4              |
cs122a.Customer.cid | 1          | 100.00          |              |

+ ------- + -------------- + --------- + -------------- +
--------- + ---------------- + ------- + ----------- +
-------- + --------- + ------------ + --------- +

2 rows
```

b.
Execute:
```
> EXPLAIN SELECT cid, email, flight_number,
projected_departure_datetime, quantity
FROM Customer NATURAL JOIN Customer_Reserves_Flight
WHERE email LIKE '%d.com'
```

```
+ ------- + -------------- + --------- + -------------- +
--------- + ---------------- + ------- + ----------- +
-------- + --------- + ------------ + --------- +
| id      | select_type    | table     | partitions     |
type      | possible_keys  | key       | key_len        | ref
| rows    | filtered       | Extra     |
+ ------- + -------------- + --------- + -------------- +
--------- + ---------------- + ------- + ----------- +
-------- + --------- + ------------ + --------- +
| 1       | SIMPLE         | Customer  |                |
index     | PRIMARY        | ix_Customer_email | 93
|         | 20             | 11.11            | Using where; Using index
|

| 1       | SIMPLE         | Customer_Reserves_Flight |
| ref     | PRIMARY        | PRIMARY | 4              |
cs122a.Customer.cid | 1        | 100.00          |              |
+ ------- + -------------- + --------- + -------------- +
```

```
--------- + ---------------- + -------- + ----------- +
-------- + --------- + ------------ + --------- +
```

2 rows

c.

Execute:

> EXPLAIN SELECT cid, email, flight_number,
projected_departure_datetime, quantity

FROM Customer NATURAL JOIN Customer_Reserves_Flight

WHERE projected_departure_datetime <= STR_TO_DATE('2015-07-01
00:00:00', '%Y-%m-%d %H:%i:%s')


```
+ ------- + -------------- + --------- + -------------- +
--------- + ---------------- + -------- + ----------- +
-------- + --------- + ------------ + --------- +
| id      | select_type    | table     | partitions    |
type       | possible_keys   | key      | key_len       | ref
| rows     | filtered       | Extra       |
+ ------- + -------------- + --------- + -------------- +
--------- + ---------------- + -------- + ----------- +
-------- + --------- + ------------ + --------- +
| 1       | SIMPLE         | Customer_Reserves_Flight |
| range     | PRIMARY,ix_CRF_projected_departure_datetime |
ix_CRF_projected_departure_datetime | 5            |         |
2         | 100.00          | Using index condition |
| 1       | SIMPLE         | Customer    |              |
eq_ref    | PRIMARY          | PRIMARY | 4            |
cs122a.Customer_Reserves_Flight.cid | 1        | 100.00
|           |
+ ------- + -------------- + --------- + -------------- +
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```

2 rows

8. By adding indexes that the query optimizer use in a query, you reduce the number of rows to examined, thus significantly reducing the execution time.

9. If MySQL were to scan the whole table, it would have to check the entire page until it finds the email. Since the index contains data entries, it points to the particular location of where the data contains, so it only needs to the read the pages the data is located. Therefore, MySQL thought it would be more efficient to use the index rather than scanning the table.

EXTRA POINT QUESTION

1.
a. Execute:
> EXPLAIN SELECT total_amount, count(*) from DishOrder DO, Dish D, Lounge L
WHERE DO.lid=D.lid and DO.total_amount > 300 and
D.price > 30 and DO.lid = L.lid and L.airport_IATA_code like 'S%'
GROUP BY DO.total_amount
HAVING count(*) > 1
ORDER BY DO.total_amount

id	select_type	table	partitions	type	possible_keys	key	key_len	ref	rows	filtered	Extra
1	SIMPLE	DO		ALL	lid				18	33.33	Using where; Using temporary; Using filesort

```
| 1        | SIMPLE          | L         |                 |
eq_ref     | PRIMARY,airport_IATA_code | PRIMARY  | 4
| cs122a.DO.lid | 1          | 69.23        | Using where |
| 1        | SIMPLE          | D         |                 | ref
| PRIMARY           | PRIMARY  | 4              | cs122a.DO.lid |
2         | 33.33          | Using where |
```

```
+ ------- + -------------- + --------- + -------------- +
--------- + ---------------- + ------- + ----------- +
-------- + --------- + ------------ + ---------- +
```

3 rows

b.

```
CREATE INDEX ix_DO_total_amount
ON DishOrder(total_amount);
```

c. Execute:

```
> EXPLAIN SELECT total_amount, count(*) from DishOrder DO, Dish
D, Lounge L
WHERE DO.lid=D.lid and DO.total_amount > 300 and
D.price > 30 and DO.lid = L.lid and L.airport_IATA_code like 'S%'
GROUP BY DO.total_amount
HAVING count(*) > 1
ORDER BY DO.total_amount
```

```
+ ------- + -------------- + --------- + -------------- +
--------- + ---------------- + ------- + ----------- +
-------- + --------- + ------------ + ---------- +
| id       | select_type     | table     | partitions      |
type       | possible_keys    | key      | key_len       | ref
| rows      | filtered        | Extra      |
+ ------- + -------------- + --------- + -------------- +
--------- + ---------------- + ------- + ----------- +
-------- + --------- + ------------ + ---------- +
```

id	select_type	table	partitions	type	possible_keys	key	key_len	ref	rows	filtered	Extra
1	SIMPLE	DO		range	lid,ix_DO_total_amount	ix_DO_total_amount	5		3	100.00	Using index condition; Using where
1	SIMPLE	L		eq_ref	PRIMARY,airport_IATA_code	PRIMARY	4	cs122a.DO.lid	1	69.23	Using where
1	SIMPLE	D		ref	PRIMARY	PRIMARY	4	cs122a.DO.lid	2	33.33	Using where

3 rows