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```
mysql> SHOW TABLES;
+------------------------------+
| Tables_in_appointment_system |
+------------------------------+
| appointments                 |
| clinics                      |
| doctors                      |
| users                        |
+------------------------------+
4 rows in set (0.01 sec)

mysql> SELECT * FROM appointments;
+----+---------+-----------+-----------+---------------------+-----------+---------------------+
| id | user_id | doctor_id | clinic_id | appointment_time    | status    | created_at          |
+----+---------+-----------+-----------+---------------------+-----------+---------------------+
|  1 |       1 |         1 |         1 | 2024-06-28 09:00:00 | booked    | 2024-06-28 20:16:57 |
|  2 |       2 |         2 |         2 | 2024-06-29 10:30:00 | booked    | 2024-06-28 20:16:57 |
|  3 |       3 |         3 |         3 | 2024-06-30 14:00:00 | booked    | 2024-06-28 20:16:57 |
|  4 |       4 |         4 |         4 | 2024-07-01 11:00:00 | booked    | 2024-06-28 20:16:57 |
|  5 |       5 |         5 |         5 | 2024-07-02 15:30:00 | booked    | 2024-06-28 20:16:57 |
|  6 |       6 |         1 |         1 | 2024-07-03 16:00:00 | booked    | 2024-06-28 20:16:57 |
|  7 |       2 |         3 |         2 | 2024-06-26 09:00:00 | cancelled | 2024-06-28 20:16:57 |
|  8 |       3 |         2 |         3 | 2024-06-27 10:30:00 | booked    | 2024-06-28 20:16:57 |
|  9 |       4 |         1 |         4 | 2024-06-28 14:00:00 | cancelled | 2024-06-28 20:16:57 |
| 10 |       5 |         3 |         5 | 2024-06-29 11:00:00 | cancelled | 2024-06-28 20:16:57 |
| 11 |       6 |         2 |         1 | 2024-06-30 15:30:00 | booked    | 2024-06-28 20:16:57 |
| 12 |       1 |         4 |         2 | 2024-07-01 16:00:00 | booked    | 2024-06-28 20:16:57 |
| 13 |       2 |         5 |         3 | 2024-07-02 08:30:00 | cancelled | 2024-06-28 20:16:57 |
| 14 |       3 |         4 |         4 | 2024-07-03 09:00:00 | booked    | 2024-06-28 20:16:57 |
| 15 |       4 |         5 |         5 | 2024-07-04 10:30:00 | booked    | 2024-06-28 20:16:57 |
+----+---------+-----------+-----------+---------------------+-----------+---------------------+
15 rows in set (0.00 sec)

mysql> SELECT * FROM clinics;
+----+----------+
| id | name     |
+----+----------+
|  1 | Clinic A |
|  2 | Clinic B |
|  3 | Clinic C |
|  4 | Clinic D |
|  5 | Clinic E |
+----+----------+
5 rows in set (0.00 sec)

mysql> SELECT * FROM doctors;
+----+-------------+
| id | name        |
+----+-------------+
|  1 | Dr. Alice   |
|  2 | Dr. Bob     |
|  3 | Dr. Charlie |
|  4 | Dr. David   |
|  5 | Dr. Eve     |
+----+-------------+
5 rows in set (0.00 sec)

mysql> SELECT * FROM users;
+----+----------------+------------+
| id | name           | birthdate  |
+----+----------------+------------+
|  1 | Jane Doe       | 1990-06-28 |
|  2 | Bob Smith      | 1985-06-29 |
|  3 | Samuel Johnson | 1978-06-30 |
|  4 | Linda Brown    | 1995-07-01 |
|  5 | George Wilson  | 1980-07-02 |
|  6 | Anna Lee       | 1992-07-03 |
+----+----------------+------------+
6 rows in set (0.00 sec)
```

1. All appointments booked in last 7 days for a doctor

QUERY:

```
SELECT *
FROM appointments
WHERE doctor_id = 1
  AND created_at >= NOW() - INTERVAL 7 DAY;
```

```
mysql> SELECT *
    -> FROM appointments
    -> WHERE doctor_id = 1
    ->   AND created_at >= NOW() - INTERVAL 7 DAY;
+----+---------+-----------+-----------+---------------------+-----------+---------------------+
| id | user_id | doctor_id | clinic_id | appointment_time    | status    | created_at          |
+----+---------+-----------+-----------+---------------------+-----------+---------------------+
|  1 |       1 |         1 |         1 | 2024-06-28 09:00:00 | booked    | 2024-06-28 20:16:57 |
|  6 |       6 |         1 |         1 | 2024-07-03 16:00:00 | booked    | 2024-06-28 20:16:57 |
|  9 |       4 |         1 |         4 | 2024-06-28 14:00:00 | cancelled | 2024-06-28 20:16:57 |
+----+---------+-----------+-----------+---------------------+-----------+---------------------+
3 rows in set (0.01 sec)
```

EXPLAIN command:

```
mysql> EXPLAIN SELECT *
    -> FROM appointments
    -> WHERE doctor_id = 1
    ->   AND created_at >= NOW() - INTERVAL 7 DAY;
+----+-------------+--------------+------------+------+---------------+-----------+---------+-------+------+----------+-------------+
| id | select_type | table        | partitions | type | possible_keys | key       | key_len | ref   | rows | filtered | Extra       |
+----+-------------+--------------+------------+------+---------------+-----------+---------+-------+------+----------+-------------+
|  1 | SIMPLE      | appointments | NULL       | ref  | doctor_id     | doctor_id | 4       | const |    3 |    33.33 | Using where |
+----+-------------+--------------+------------+------+---------------+-----------+---------+-------+------+----------+-------------+
1 row in set, 1 warning (0.00 sec)
```

2. All appointments booked in last 2 days and scheduled within next 5 hours for a doctor

QUERY:

```
SELECT *
FROM appointments
WHERE doctor_id = 1
  AND created_at >= NOW() - INTERVAL 2 DAY
  AND appointment_time <= NOW() + INTERVAL 5 HOUR;
```

```
mysql> SELECT *
    -> FROM appointments
    -> WHERE doctor_id = 1
    ->   AND created_at >= NOW() - INTERVAL 2 DAY
    ->   AND appointment_time <= NOW() + INTERVAL 5 HOUR;
+----+---------+-----------+-----------+---------------------+-----------+---------------------+
| id | user_id | doctor_id | clinic_id | appointment_time    | status    | created_at          |
+----+---------+-----------+-----------+---------------------+-----------+---------------------+
|  1 |       1 |         1 |         1 | 2024-06-28 09:00:00 | booked    | 2024-06-28 20:16:57 |
|  9 |       4 |         1 |         4 | 2024-06-28 14:00:00 | cancelled | 2024-06-28 20:16:57 |
+----+---------+-----------+-----------+---------------------+-----------+---------------------+
2 rows in set (0.01 sec)
```

EXPLAIN command:

```
mysql> EXPLAIN SELECT *
    -> FROM appointments
    -> WHERE doctor_id = 1
    ->   AND created_at >= NOW() - INTERVAL 2 DAY
    ->   AND appointment_time <= NOW() + INTERVAL 5 HOUR;
+----+-------------+--------------+------------+------+---------------+-----------+---------+-------+------+----------+-------------+
| id | select_type | table        | partitions | type | possible_keys | key       | key_len | ref   | rows | filtered | Extra       |
+----+-------------+--------------+------------+------+---------------+-----------+---------+-------+------+----------+-------------+
|  1 | SIMPLE      | appointments | NULL       | ref  | doctor_id     | doctor_id | 4       | const |    3 |    11.11 | Using where |
+----+-------------+--------------+------------+------+---------------+-----------+---------+-------+------+----------+-------------+
1 row in set, 1 warning (0.02 sec)
```

3. Users who have at least 1 appointment and have their birthday coming in next 5 days

QUERY:

SELECT DISTINCT u.*
FROM users u
JOIN appointments a ON u.id = a.user_id
WHERE DATE_FORMAT(u.birthdate, '%m-%d') BETWEEN DATE_FORMAT(CURDATE(), '%m-%d') AND DATE_FORMAT(CURDATE() + INTERVAL 5 DAY, '%m-%d');

EXPLAIN command and the corresponding query:

```
mysql> SELECT DISTINCT u.*
    -> FROM users u
    -> JOIN appointments a ON u.id = a.user_id
    -> WHERE DATE_FORMAT(u.birthdate, '%m-%d') BETWEEN DATE_FORMAT(CURDATE(), '%m-%d') AND DATE_FORMAT(CURDATE() + INTERVAL 5 DAY, '%m-%d');
+----+----------------+------------+
| id | name           | birthdate  |
+----+----------------+------------+
|  1 | Jane Doe       | 1990-06-28 |
|  2 | Bob Smith      | 1985-06-29 |
|  3 | Samuel Johnson | 1978-06-30 |
|  4 | Linda Brown    | 1995-07-01 |
|  5 | George Wilson  | 1980-07-02 |
|  6 | Anna Lee       | 1992-07-03 |
+----+----------------+------------+
6 rows in set (0.00 sec)

mysql> EXPLAIN SELECT DISTINCT u.*
    -> FROM users u
    -> JOIN appointments a ON u.id = a.user_id
    -> WHERE DATE_FORMAT(u.birthdate, '%m-%d') BETWEEN DATE_FORMAT(CURDATE(), '%m-%d') AND DATE_FORMAT(CURDATE() + INTERVAL 5 DAY, '%m-%d');
+----+-------------+-------+------------+------+---------------+---------+---------+--------------------------+------+----------+----------------------------+
| id | select_type | table | partitions | type | possible_keys | key     | key_len | ref                      | rows | filtered | Extra                      |
+----+-------------+-------+------------+------+---------------+---------+---------+--------------------------+------+----------+----------------------------+
|  1 | SIMPLE      | u     | NULL       | ALL  | PRIMARY       | NULL    | NULL    | NULL                     |    6 |   100.00 | Using where; Using temporary |
|  1 | SIMPLE      | a     | NULL       | ref  | user_id       | user_id | 4       | appointment_system.u.id |    1 |   100.00 | Using index; Distinct        |
+----+-------------+-------+------------+------+---------------+---------+---------+--------------------------+------+----------+----------------------------+
2 rows in set, 1 warning (0.00 sec)
```

4. Appointments for a particular patient in the last 7 days

QUERY:

```
SELECT *
FROM appointments
WHERE user_id = 1
  AND created_at >= NOW() - INTERVAL 7 DAY;
```

QUERY and EXPLAIN command:

```
mysql> SELECT *
    -> FROM appointments
    -> WHERE user_id = 1
    ->   AND created_at >= NOW() - INTERVAL 7 DAY;
+----+---------+-----------+-----------+---------------------+--------+---------------------+
| id | user_id | doctor_id | clinic_id | appointment_time    | status | created_at          |
+----+---------+-----------+-----------+---------------------+--------+---------------------+
|  1 |       1 |         1 |         1 | 2024-06-28 09:00:00 | booked | 2024-06-28 20:16:57 |
| 12 |       1 |         4 |         2 | 2024-07-01 16:00:00 | booked | 2024-06-28 20:16:57 |
+----+---------+-----------+-----------+---------------------+--------+---------------------+
2 rows in set (0.02 sec)

mysql> EXPLAIN SELECT *
    -> FROM appointments
    -> WHERE user_id = 1
    ->   AND created_at >= NOW() - INTERVAL 7 DAY;
+----+-------------+--------------+------------+------+---------------+---------+---------+-------+------+----------+-------------+
| id | select_type | table        | partitions | type | possible_keys | key     | key_len | ref   | rows | filtered | Extra       |
+----+-------------+--------------+------------+------+---------------+---------+---------+-------+------+----------+-------------+
|  1 | SIMPLE      | appointments | NULL       | ref  | user_id       | user_id | 4       | const |    2 |    33.33 | Using where |
+----+-------------+--------------+------------+------+---------------+---------+---------+-------+------+----------+-------------+
1 row in set, 1 warning (0.00 sec)
```

5. Appointment cancellation percentage for a doctor by clinic

QUERY:

```
SELECT c.name AS clinic_name,
      d.name AS doctor_name,
      (SUM(a.status = 'cancelled') / COUNT(*)) * 100 AS cancellation_percentage
FROM appointments a
JOIN clinics c ON a.clinic_id = c.id
JOIN doctors d ON a.doctor_id = d.id
WHERE a.doctor_id = 3
GROUP BY c.id, d.id;
```

QUERY and EXPLAIN command:

```
mysql> SELECT c.name AS clinic_name,
    ->        d.name AS doctor_name,
    ->        (SUM(a.status = 'cancelled') / COUNT(*)) * 100 AS cancellation_percentage
    -> FROM appointments a
    -> JOIN clinics c ON a.clinic_id = c.id
    -> JOIN doctors d ON a.doctor_id = d.id
    -> WHERE a.doctor_id = 3
    -> GROUP BY c.id, d.id;
+-------------+-------------+--------------------------+
| clinic_name | doctor_name | cancellation_percentage |
+-------------+-------------+--------------------------+
| Clinic C    | Dr. Charlie |                   0.0000 |
| Clinic B    | Dr. Charlie |                 100.0000 |
| Clinic E    | Dr. Charlie |                 100.0000 |
+-------------+-------------+--------------------------+
3 rows in set (0.01 sec)
```

```
mysql> EXPLAIN SELECT c.name AS clinic_name,
    ->        d.name AS doctor_name,
    ->        (SUM(a.status = 'cancelled') / COUNT(*)) * 100 AS cancellation_percentage
    -> FROM appointments a
    -> JOIN clinics c ON a.clinic_id = c.id
    -> JOIN doctors d ON a.doctor_id = d.id
    -> WHERE a.doctor_id = 3
    -> GROUP BY c.id, d.id;
+----+-------------+-------+------------+--------+---------------------+-----------+---------+-------------------------------+------+----------+-----------------+
| id | select_type | table | partitions | type   | possible_keys       | key       | key_len | ref                           | rows | filtered | Extra           |
+----+-------------+-------+------------+--------+---------------------+-----------+---------+-------------------------------+------+----------+-----------------+
|  1 | SIMPLE      | d     | NULL       | const  | PRIMARY             | PRIMARY   | 4       | const                         |    1 |   100.00 | Using temporary |
|  1 | SIMPLE      | a     | NULL       | ref    | doctor_id,clinic_id | doctor_id | 4       | const                         |    3 |   100.00 | NULL            |
|  1 | SIMPLE      | c     | NULL       | eq_ref | PRIMARY             | PRIMARY   | 4       | appointment_system.a.clinic_id |    1 |   100.00 | NULL            |
+----+-------------+-------+------------+--------+---------------------+-----------+---------+-------------------------------+------+----------+-----------------+
3 rows in set, 1 warning (0.01 sec)
```

The relationship diagram between the tables created is given below: