IT214 - DBMS

IRCTC Management System

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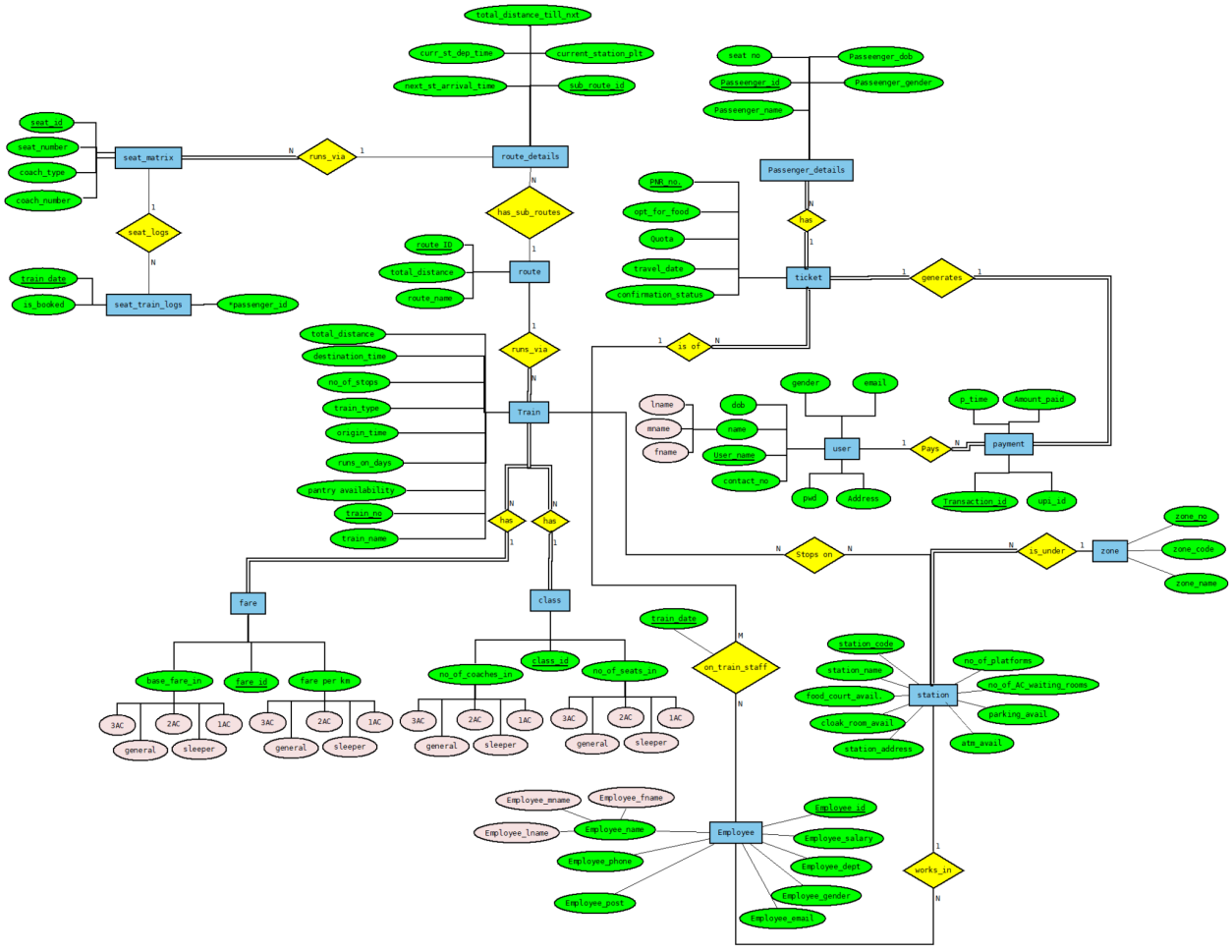
ERD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coach_number
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Pays
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Amount_paid
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zone
zone_no
zone_code
zone_name
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on_train_staff
station_code
station_name
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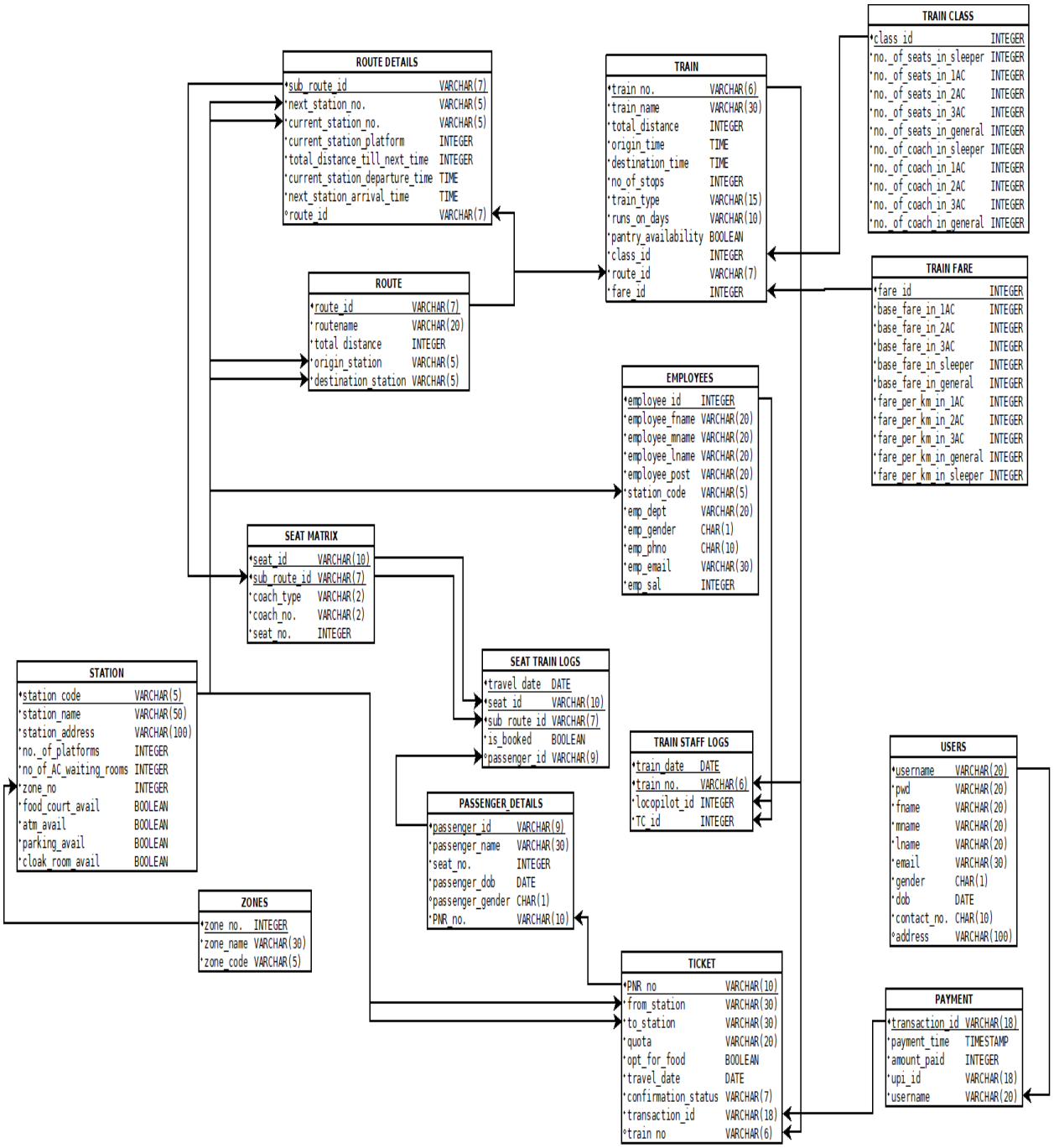
no_of_platforms
no_of_AC_waiting_rooms
parking_avail
atm_avail
Employee_mname
Employee_fname
Employee_lname
Employee_name
Employee_phone
Employee_post
Employee
Employee_id
Employee_salary
Employee_dept
Employee_gender
Employee_email
works_in

Relational Schema



Minimal FDs Set:-

- class_id → {nos_sl, nos_1a, nos_2a, nos_3a, nos_gen, noc_sl, noc_1a, noc_2a, noc_3a, noc_gen}
- fare_id → {bf_1a, bf_2a, bf_3a, bf_sl, bf_gen, fpk_1a, fpk_2a, fpk_3a, fpk_sl, fpk_gen}
- zone_no → {zone_name, zone_code}
- station_code → {station_name, station_address, no_of_platforms, no_of_waiting_rooms, zone_no, food_court_avail, atm_avail, parking_avail, cloak_room_avail}
- emp_id → {emp_fname, emp_mname, emp_lname, emp_post, station_code, emp_dept, emp_gender, emp_phno, emp_email}
- user_name → {passwd, fname, mname, lname, email, gender, dob, contact_no, address}
- transaction_id → {p_time, amt_paid, upi_id, user_name}
- Route_id → {route_name, total_dist, origin_stn, destn_stn}
- Sub_route_id → {next_stn, cur_stn, curstn_plt, total_dist_till_nxt, cur_st_dept, nxt_st_arrivlt, route_id}
- train_no → {train_name, total_distance, origin_time, dstn_time, no_of_stops, train_type, runs_on_days, pantry_avail, class_id, route_id, fare_id}
- (train_no, train_date) → {loco_id, tc_id}
- pnr_no → {from_stn, to_stn, quota, opt_for_food, travel_date, cnf_status, transaction_id, train_no}
- passenger_id → {passenger_name, seat_no, passenger_dob, passenger_gender, pnr_no}
- (seat_id, sub_route_id) → {coach_type, coach_number, seat_number}
- (travel_date, seat_id, sub_route_id) → {is_booked, passenger_id}

BCNF Proofs :

1. **‘train_class’ relation:**
    - Attributes:
        - train_class {class_id, nos_sl, nos_1a, nos_2a, nos_3a, nos_gen, noc_sl, noc_1a, noc_2a, noc_3a, noc_gen}
    - Functional Dependency:
        - class_id ➔ {nos_sl, nos_1a, nos_2a, nos_3a, nos_gen, noc_sl, noc_1a, noc_2a, noc_3a, noc_gen}

Let X = class_id

X^+ = {class_id, nos_sl, nos_1a, nos_2a, nos_3a, nos_gen, noc_sl, noc_1a, noc_2a, noc_3a, noc_gen}

Primary key: **class_id**

The left side of all FDs in the minimal set of FDs for the relation 'train_class' is class_id, which is the primary key of this relation. Therefore, "**train_class**" is in **BCNF**.

2. **‘train_fare’ relation:**
    - Attributes:
        - train_fare {fare_id,bf_1a, bf_2a, bf_3a, bf_sl, bf_gen, fpk_1a, fpk_2a, fpk_3a, fpk_sl, fpk_gen}
    - Functional Dependency:
        - fare_id ➔ {bf_1a, bf_2a, bf_3a, bf_sl, bf_gen, fpk_1a, fpk_2a, fpk_3a, fpk_sl, fpk_gen}

Let X = fare_id

X^+ = {fare_id, bf_1a, bf_2a, bf_3a, bf_sl, bf_gen, fpk_1a, fpk_2a, fpk_3a, fpk_sl, fpk_gen}

Primary key: **fare_id**

The left side of all FDs in the minimal set of FDs for the relation 'train_fare' is fare_id, which is the primary key of this relation. Therefore, "**train_fare**" is in **BCNF**.

3. **‘zones’ relation:**
    - Attributes:
        - zones {zone_no, zone_name, zone_code}
    - Functional Dependency:
        - zone_no ➜ {zone_name, zone_code}

Let X = zone_no

X^+ = {zone_no, zone_name, zone_code}

Primary key: **zone_no**

The left side of all FDs in the minimal set of FDs for the relation 'zones' is zone_no, which is the primary key of this relation. Therefore, "**zones**" is in **BCNF**.

4. **‘station’ relation:**
    - Attributes:
        - station {station_code, station_name, station_address, no_of_platforms, no_of_waiting_rooms, zone_no, food_court_avail, atm_avail, parking_avail, cloak_room_avail}
    - Functional Dependency:
        - station_code ➜ {station_name, station_address, no_of_platforms, no_of_waiting_rooms, zone_no, food_court_avail, atm_avail, parking_avail, cloak_room_avail}

Let X = station_code

X^+ = {station_code, station_name, station_address, no_of_platforms, no_of_waiting_rooms, zone_no, food_court_avail, atm_avail, parking_avail, cloak_room_avail}

Primary key: **station_code**

The left side of all FDs in the minimal set of FDs for the relation 'station' is station_code, which is the primary key of this relation. Therefore, "**station**" is in **BCNF**.

5. **‘employees’ relation:**
    - Attributes :
        - employees {emp_id, emp_fname, emp_mname, emp_lname, emp_post, station_code, emp_dept, emp_gender, emp_phno, emp_email}
    - Functional Dependency:
        - emp_id ➜ {emp_fname, emp_mname, emp_lname, emp_post, station_code, emp_dept, emp_gender, emp_phno, emp_email}

Let X = emp_id

X^+ = {emp_id, emp_fname, emp_mname, emp_lname, emp_post, station_code, emp_dept, emp_gender, emp_phno, emp_email}

Primary key: **emp_id**

The left side of all FDs in the minimal set of FDs for the relation 'employees' is emp_id, which is the primary key of this relation. Therefore, "**employees**" is in **BCNF**.

6. **‘users’ relation:**
    - Attributes :
        - users {user_name, passwd, fname, mname, lname, email, gender, dob, contact_no, address}
    - Functional Dependency:
        - user_name ➜ {passwd, fname, mname, lname, email, gender, dob, contact_no, address}

Let X = user_name

X^+ = {user_name, passwd, fname, mname, lname, email, gender, dob, contact_no, address}

Primary key: **user_name**

The left side of all FDs in the minimal set of FDs for the relation 'users' is user_name, which is the primary key of this relation. Therefore, "**users**" is in **BCNF**.

7. **‘payment’ relation:**
    - Attributes :
        - payment {transaction_id, p_time, amt_paid, upi_id, user_name}
    - Functional Dependency:
        - transaction_id ➜ {p_time, amt_paid, upi_id, user_name}

Let X = transaction_id

X^+ = {transaction_id, p_time, amt_paid, upi_id, user_name}

Primary key: **transaction_id**

The left side of all FDs in the minimal set of FDs for the relation 'payment' is transaction_id, which is the primary key of this relation. Therefore, "**payment**" is in **BCNF**.

8. **‘route’ relation:**
    - Attributes :
        - route {route_id, route_name, total_dist, origin_stn, destn_stn}
    - Functional Dependency:
        - route_id ➜ {route_name, total_dist, origin_stn, destn_stn}

Let X = route_id

X^+ = {route_id, route_name, total_dist, origin_stn, destn_stn}

Primary key: **route_id**

The left side of all FDs in the minimal set of FDs for the relation 'route' is Route_id, which is the primary key of this relation. Therefore, "**route**" is in **BCNF**.

9. **‘route_details’ relation:**
    - Attributes :
        - route_details {sub_route_id, next_stn, cur_stn, curstn_plt, total_dist_till_nxt, cur_st_dept, nxt_st_arrivlt, route_id}
    - Functional Dependency:
        - sub_route_id ➜ {next_stn, cur_stn, curstn_plt, total_dist_till_nxt, cur_st_dept, nxt_st_arrivlt, route_id}

Let X = sub_route_id

X^+ = {sub_route_id, next_stn, cur_stn, curstn_plt, total_dist_till_nxt, cur_st_dept, nxt_st_arrivlt, route_id}

Primary key: **sub_route_id**

The left side of all FDs in the minimal set of FDs for the relation 'route_details' is Sub_route_id, which is the primary key of this relation. Therefore, "**route_details**" is in **BCNF**.

10. **‘train’ relation:**
    - Attributes :
        - train {train_no, train_name, total_distance, origin_time, dstn_time, no_of_stops, train_type, runs_on_days, pantry_avail, class_id, route_id, fare_id}
    - Functional Dependency:
        - train_no ➜ {train_name, total_distance, origin_time, dstn_time, no_of_stops, train_type, runs_on_days, pantry_avail, class_id, route_id, fare_id}

Let X = train_no

X^+ = {train_no, train_name, total_distance, origin_time, dstn_time, no_of_stops, train_type, runs_on_days, pantry_avail, class_id, route_id, fare_id}

Primary key: **train_no**

The left side of all FDs in the minimal set of FDs for the relation 'train' is train_no, which is the primary key of this relation. Therefore, "**train**" is in **BCNF**.

11. ‘train_staff_logs’ relation:

- Attributes :
  - train_staff_logs {(train_no, train_date), loco_id, tc_id}
- Functional Dependency:
  - (train_no, train_date) ➜ {loco_id, tc_id}

Let X = (train_no, train_date)

X^+ = {(train_no, train_date), loco_id, tc_id}

Primary key: **(train_no, train_date)**

The left side of all FDs in the minimal set of FDs for the relation 'train_staff_logs' is (train_no, train_date), which is the primary key of this relation. Therefore, "(**train_staff_logs**)" is in **BCNF**.

12. ‘ticket’ relation:

- Attributes :
  - ticket{pnr_no, from_stn, to_stn, quota, opt_for_food, travel_date, cnf_status, transaction_id, train_no}
- Functional Dependency:
  - pnr_no ➜ {from_stn, to_stn, quota, opt_for_food, travel_date, cnf_status, transaction_id, train_no}

Let X = pnr_no

X^+ = {pnr_no, from_stn, to_stn, quota, opt_for_food, travel_date, cnf_status, transaction_id, train_no}

Primary key: **pnr_no**

The left side of all FDs in the minimal set of FDs for the relation 'ticket' is pnr_no, which is the primary key of this relation. Therefore, "**ticket**" is in **BCNF**.

13. ‘passenger_details’ relation:

- Attributes :
  - passenger_details {passenger_id, passenger_name, seat_no, passenger_dob, passenger_gender, pnr_no}
- Functional Dependency:
  - passenger_id ➜ {passenger_name, seat_no, passenger_dob, passenger_gender, pnr_no}

Let X = passenger_id

X^+ = {passenger_id, passenger_name, seat_no, passenger_dob, passenger_gender, pnr_no}

Primary key: **passenger_id**

The left side of all FDs in the minimal set of FDs for the relation 'passenger_details' is passenger_id, which is the primary key of this relation. Therefore, "**passenger_details**" is in **BCNF**.

14. ‘seat_matrix’ relation:

- Attributes :
  - seat_matrix {(seat_id, sub_route_id), coach_type, coach_number, seat_number}
- Functional Dependency:
  - (seat_id, sub_route_id) ➜ {coach_type, coach_number, seat_number}

Let X = (seat_id, sub_route_id)

X^+ = {(seat_id, sub_route_id), coach_type, coach_number, seat_number}

Primary key: (**seat_id, sub_route_id**)

The left side of all FDs in the minimal set of FDs for the relation 'seat_matrix' is (seat_id, sub_route_id), which is the primary key of this relation. Therefore, "(**seat_matrix**)" is in **BCNF**.

15. ‘seat_train_logs’ relation:

- Attributes :
  - seat_train_logs {(travel_date, seat_id, sub_route_id), is_booked, passenger_id}
- Functional Dependency:
  - (travel_date, seat_id, sub_route_id) ➜ {is_booked, passenger_id}

Let X = (travel_date, seat_id, sub_route_id)

X^+ = {(travel_date, seat_id, sub_route_id), is_booked, passenger_id}

Primary key: **(travel_date, seat_id, sub_route_id)**

The left side of all FDs in the minimal set of FDs for the relation 'seat_train_logs' is (travel_date, seat_id, sub_route_id), which is the primary key of this relation. Therefore, "(**seat_train_logs**)" is in **BCNF**.