Functional Dependency and Normalization

1) Customer (cust_id, cust_name, address_line_1, area, city, state, pin_code)

This table is in 2NF.

{cust_id} -> cust_name

{cust_id} -> address_line_1

{cust_id} -> area

{cust_id} -> city

{cust_id} -> state

{cust_id} -> pin_code

{pin_code} -> area

{pin_code} -> city

{pin_code} -> state

Candidate Key: {cust_id}

Prime Attribute: cust_id, pin_code

Non-Prime Attribute: cust_name, address_line_1, area, city, state

Normalization to 3NF and BCNF:

pincode is not unique, thus it is in 2NF form. So, to convert it to BCNF cust_id and pincode will be together declared as a super key which will uniquely identify user city and user state.

{cust_id} -> cust_name

{cust_id} -> address_line_1

{cust_id, pin_code} -> area

{cust_id, pin_code} -> city

{cust_id, pin_code} -> state

2) Phone_no (cust_id, phone_no)

This table is in 3NF and BCNF.

{cust_id} -> phone_no

Candidate Key: {cust_id}

Prime Attribute: cust_id

Non-Prime Attribute: phone_no

Explanation:

A relation is in third normal form and BCNF, as there is no transitive dependency for non-prime attributes as well as it is in second normal form.

3) Electricity_board (eb_id, eb_name, status, note)

This table is in 3NF and BCNF.

{eb_id} -> eb_name

{eb_id} -> status

{eb_id} -> note

Candidate Key: {eb_id}

Prime Attribute: eb_id

Non-Prime Attribute: eb_name, status, note

Explanation:

A relation is in third normal form and BCNF, as there is no transitive dependency for non-prime attributes as well as it is in second normal form.

4) Tarrif (tarif_id, eb_id, tarrif_type, tarrif_description, tarrif_rate)

This table is in 3NF and BCNF.

{tarrif_id} -> tarrif_type

{tarrif_id} -> eb_id

{tarrif_id} -> tarrif_description

{tarrif_id} -> tarrif_rate

Candidate Key: {tarrif_id}

Prime Attribute: tarrif_id

Non-Prime Attribute: tarif_type, eb_id, tarrif_description, tarrif_rate

Explanation:

A relation is in third normal form and BCNF, as there is no transitive dependency for non-prime attributes as well as it is in second normal form.

5) Account (account_id, account_no, cust_id, eb_id, rr_no, email_id, password)

This table is in 3NF and BCNF.

{account_id} -> account_no

{account_id} -> cust_id

{account_id} -> eb_id

{account_id} -> rr_no

{account_id} -> email_id

{account_id} -> password

Candidate Key: {account_id}

Prime Attribute: account_id

Non-Prime Attribute: account_no, cust_id, rr_no, email_id, password

Explanation:

A relation is in third normal form and BCNF, as there is no transitive dependency for non-prime attributes as well as it is in second normal form.

6) Department (dept_no,eb_id, dept_name)

This table is in 3NF and BCNF.

{dept_no} -> eb_id

{dept_no} -> dept_name

Candidate Key: {dept_no}

Prime Attribute: dept_no

Non-Prime Attribute: eb_id**,** dept_name

Explanation:

A relation is in third normal form and BCNF, as there is no transitive dependency for non-prime attributes as well as it is in second normal form.

7) Employee (emp_id, eb_id, dept_no, emp_name, emp_post)

This table is in 3NF and BCNF.

{emp_id} -> eb_id

{emp_id} -> dept_no

{emp_id} -> emp_name

{emp_id} -> emp_post

Candidate Key: {emp_id}

Prime Attribute: emp_id

Non-Prime Attribute: eb_id, dept_no, emp_name, emp_post

Explanation:

A relation is in third normal form and BCNF, as there is no transitive dependency for non-prime attributes as well as it is in second normal form.

8) Invoice (invoice_id, emp_id, account_id, present_reading, reading_date, consumption_unit, previous_reading, previous_balance, fixed_charge, energy_charge, tax, bill_amount, due_date)

This table is in 3NF and BCNF.

{invoice_id} -> emp_id

{invoice_id} -> account_id

{invoice_id} -> present_reading

{invoice_id} -> reading_date

{invoice_id} -> consumption_unit

{invoice_id} -> previous_reading

{invoice_id} -> previous_balance

{invoice_id} -> fixed_charge

{invoice_id} -> energy_charge

{invoice_id} -> tax

{invoice_id} -> bill_amount

{invoice_id} -> due_date

Candidate Key: {invoice_id}

Prime Attribute: invoice_id

Non-Prime Attribute: emp_id, account_id, present_reading, reading_date, consumption_unit, previous_reading, previous_balance, fixed_charge, energy_charge, tax, bill_amount, due_date

Explanation:

A relation is in third normal form and BCNF, as there is no transitive dependency for non-prime attributes as well as it is in second normal form.

9) Payment (trans_id, invoice_id, account_id, payment_mode, payment_date, payment_time, bill_amount, paid_amount, excess_paid, status)

This table is in 3NF and BCNF.

{trans_id} -> invoice_id

{trans_id} -> account_id

{trans_id} -> payment_mode

{trans_id} -> payment_date

{trans _id} -> payment_time

{trans _id} -> bill_amount

{trans _id} -> paid_amount

{trans _id} -> excess_paid

{trans _id} -> status

Candidate Key: {trans_id}

Prime Attribute: trans_id

Non-Prime Attribute: invoice_id, account_id, payment_mode, payment_date, payment_time, bill_amount, paid_amount, excess_paid, status

Explanation:

A relation is in third normal form and BCNF, as there is no transitive dependency for non-prime attributes as well as it is in second normal form.

10) Feedback (feedback_id, feedback_date, account_id, description, type)

This table is in 3NF and BCNF.

{feedback_id} -> feedback_date

{feedback_id} -> account_id

{feedback_id} -> description

{feedback_id} -> type

Candidate Key: {feedback_id}

Prime Attribute: feedback_id

Non-Prime Attribute: feedback_date, account_id, description, type

Explanation:

A relation is in third normal form and BCNF, as there is no transitive dependency for non-prime attributes as well as it is in second normal form.

11) Maintenance (maintenance_id, emp_id, account_id, m_created_date, m_resolved_date, maintenance_status)

This table is in 3NF and BCNF.

{maintenance_id} -> emp_id

{maintenance_id} -> account_id

{maintenance_id} -> m_created_date

{maintenance_id} -> m_resolved_date

{maintenance_id} -> maintenance_status

Candidate Key: {maintenance_id}

Prime Attribute: maintenance_id

Non-Prime Attribute: emp_id, account_id, m_created_date, m_resolved_date, maintenance_status

Explanation:

A relation is in third normal form and BCNF, as there is no transitive dependency for non-prime attributes as well as it is in second normal form.