

DEAKIN UNIVERSITY

DATABASE FUNDAMENTALS

ONTRACK SUBMISSION

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## Miniproject Part-1 - Database Design and Normalisation

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Outcome	Weight
Fundamental concepts of database	♦♦♦♦◊
Relational Database Modelling	♦♦♦♦◊
Structured Query Language (SQL)	♦♦♦♦◊
Reflection	♦♦♦♦◊
Research and critical review	♦♦♦♦◊

The task is related to the ULO

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# SIT772 - Data and Information Management

## Trimester 2 2025

### MINI-PROJECT PART 1

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## **I. Overview of the company AAMI (Australian Associated Motor Insurers Limited)**

AAMI is a major Australian insurer providing a broad range of insurance products, primarily for individuals and small to medium businesses. Their offerings include motor vehicle, home and contents, landlord, travel, business, life and income protection, pet insurance, and Compulsory Third Party (CTP) insurance. Services are accessible online and via phone.

### **1. Policy Management**

- Creation and Issuance: Customers apply for insurance policies specifying the type (car, home, business, life, etc.), coverage details, premiums, excess amounts, payment plans, and effective/expiry dates.
- Policy Endorsements: Customers can update policies during their term by adding or removing covered items (e.g., vehicles, properties), changing drivers or insured persons, or modifying coverage options.
- Renewals and Cancellations: Automated and manual processes handle policy renewals, premium recalculations, or policy cancellations.
- Premium Calculation: Premiums are calculated based on risk profiles, including insured assets, driver history, property location, and claim records.

### **2. Customer Management**

- Customer Profiles: Stores detailed personal and contact information for individual and business customers, including communication preferences and account statuses.
- Multiple Policies: Customers may hold multiple policies linked to their profile.
- Discount Application: Loyalty, multi-policy, online purchase, and other discount schemes are applied to eligible customers or policies.
- Customer Support: Includes service inquiries, complaint resolution, policy advice, and claim assistance.

### **3. Claims Processing**

- Claim Lodgement: Customers report incidents (accidents, theft, damage) via online portals or phone, submitting all required details and supporting documents.
- Assessment: Claims staff assess damage, verify coverage, request quotations or reports (e.g., from repairers or assessors), and determine claim validity.
- Authorization and Settlement: Based on assessment, claims are approved, rejected, or adjusted. Payments or repairs are arranged accordingly.
- Express Settlements: Eligible claims under certain amounts may be processed rapidly online with minimal manual intervention.
- Documentation and Tracking: Customers can track claim status and provide additional documentation as requested.

#### 4. Payments and Billing

- Premium Payments: Customers can pay in full or by installments; payment statuses are recorded.
- Excess Payments: Payments due when claims are made are tracked and managed.
- Refunds and Adjustments: Following claim outcomes or policy changes, appropriate refunds or premium adjustments are processed.
- Due Dates and Notifications: Automated systems manage reminders and overdue notices.

#### 5. Discounts and Promotions

- Types of Discounts: Includes multi-policy discounts, loyalty incentives, and online purchase bonuses.
- Application Logic: Discounts are linked to customers or individual policies and have validity periods and eligibility rules.
- Automated Calculation: Discount eligibility is evaluated at policy issuance and renewal.

#### 6. Business Insurance (for Small and Home Businesses)

- AAMI offers specialized business insurance, including public and products liability, business interruption, property damage, and portable and valuable items coverage.
- Business insurance can be combined with home insurance in 'Business Home' packages.
- Coverage extends to business assets, tools of trade, and business-related liabilities.
- Claims and coverage management reflect business-specific scenarios, including risk mitigation for disruptions.

#### 7. Use Case Scenarios

- New Policy Application: Customer enters personal and asset details online or via agent; policy terms and premium calculated; policy issued electronically.
- Claim Lodgement: Following an incident (e.g., car accident or home burglary), the customer submits a claim with evidence and descriptions; a claim number is issued immediately.
- Express Claim Settlement: For claims under set thresholds, rapid online claim approval with prompt payment.
- Policy Update: Customer adds a new insured driver or vehicle, triggering premium recalculation and policy endorsement.
- Premium Payment: Customer selects payment plan; payments are recorded; overdue payments trigger reminders.
- Discount Assignment: Multiple policies trigger automated loyalty discount; documented in policy records.

- Customer Support: Customers request assistance or dispute resolution via phone or web chat; staff access customer and claim data.

## II. Business Rules for Database Modeling

### 1. Unique Identifiers and Entities

- Customers must have a unique CustomerID to identify personal and contact information.
- Policies have unique PolicyIDs linked to one customer.
- Covered items (cars, homes, business assets) have unique CoveredItemIDs and belong to exactly one policy.
- Claims are uniquely identified by ClaimID and are linked to one policy.
- Discounts have unique DiscountIDs and may be associated with multiple policies.
- ClaimHandlers (Staff) have unique StaffIDs and manage claims.

### 2. Relationships and Cardinalities

- One customer can own multiple policies (1-to-many).
- One policy can cover multiple insured items (1-to-many).
- One policy can have multiple claims (1-to-many).
- One discount can apply to many policies (1-to-many or many-to-many via a join entity if needed).
- One claim is handled by exactly one handler (many claims to one staff).

### 3. Atomicity and Attribute Dependencies

- All data fields are atomic (e.g., names split into first/last, contact numbers singular).
- No repeating groups or multi-valued attributes allowed in the same field.
- Attributes depend solely on their entity's primary key (no partial dependencies).
- Related data prone to change independently (e.g., discount info, handler info) is factored into separate entities (to avoid transitive dependencies).

### 4. Business and Policy-Specific Rules

- Policy status fields must reflect valid states (active, expired, cancelled).
- Covered items must capture sufficient attributes like registration number (cars), address (properties), and make/model/year to establish risk and premium.
- Claims must track detailed status and outcomes, with timestamps for incident and claim lodgement.
- Customers may have multiple contact points, but they must be recorded distinctly and updated regularly.
- Discounts have eligibility rules (duration, conditions) and are applied only if the criteria are met.

- Claim handlers must be identifiable and linked to claims for accountability and processing.

## 5. Data Integrity and Constraints

- Foreign key constraints maintain referential integrity (e.g., claims must reference existing policies).
- Policy renewal dates and expiry dates must be logically consistent.
- Claims must be linked only to policies valid at the time of the incident.
- Data on payments and billing (although excluded here) must reflect due/paid statuses and installments.

## 6. Privacy and Security Notes

- While not explicit in data modeling, customer privacy implies encryption or access controls on sensitive fields such as contact info and personal identifiers.

These rules structure the database design, enforcing uniqueness, integrity, and clear separations for an efficient insurance management system. They provide foundations for your entity definitions, attribute choices, relationships, and normalization.

## III. Dependency Diagram and Normalization: From 1NF to 3NF

### 1. 1NF (First Normal Form)

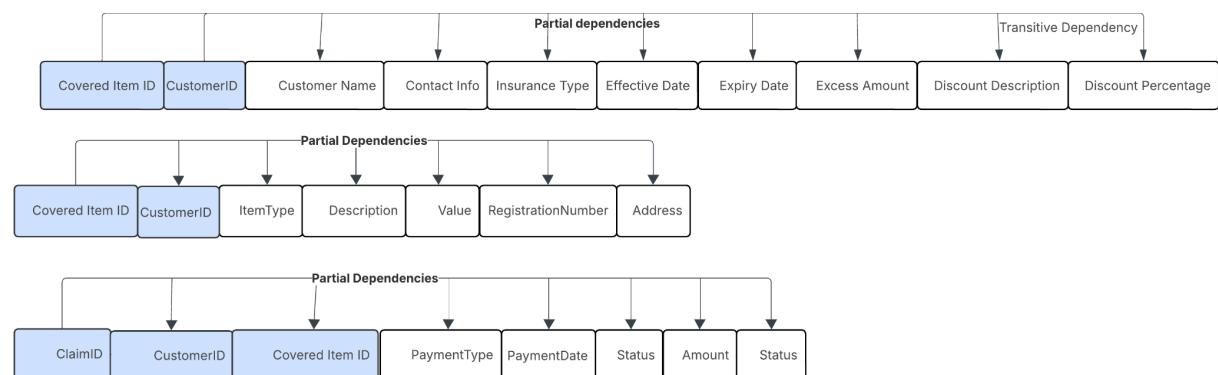


Figure 1: The first normal form dependency diagram of the AAMI company  
 Atomic attributes are designed to hold a single value. For instance, Customer\_Name, Contact\_Info, and Amount are considered atomic, and there are no multi-valued fields, meaning attributes do not contain lists of discounts or multiple claim handler names. Every entity is assigned a distinct primary key: Customer\_ID for customer cases, Covered\_Item\_ID for covered items, and Claim\_ID for claim cases. This setup complies with the core rules of First Normal Form (1NF), ensuring each table row is unique and contains atomic values. However, while 1NF is achieved, the entities may still present potential issues that require attention during normalization.

## Anomalies

- *Insertion anomalies*

These potential anomalies in 1NF include insertion anomalies, where embedding discount details directly within Customer Policy could make it impossible to add new discounts without linking them to a policy, leading to inconsistent discount information across multiple policies.

- *Update anomalies*

There are also update anomalies; modifying a discount's description or percentage would necessitate updates to various covered items records, increasing the risk of inconsistency.

- *Deletion anomalies*

Deletion anomalies could arise if removing a CustomerPolicy record inadvertently eliminates associated discount information. Redundancy within the data is also a concern, as repeating discount descriptions and percentages across numerous policy records amplifies storage needs and maintenance efforts. Additionally, transitive dependencies exist; for example, attributes like DiscountDescription rely on DiscountID, which is not a key within CustomerPolicy, and ClaimHandlerName depends on a claim handler entity, violating the rules of Third Normal Form (3NF).

Looking ahead to the next steps for normalization, the transition to Second Normal Form (2NF) is needed. Since all entity primary keys are single columns, no partial dependencies require removal. If composite keys existed, we would eliminate attributes that depend solely on a part of the composite key.

## 2. 2NF (Second Normal Form)

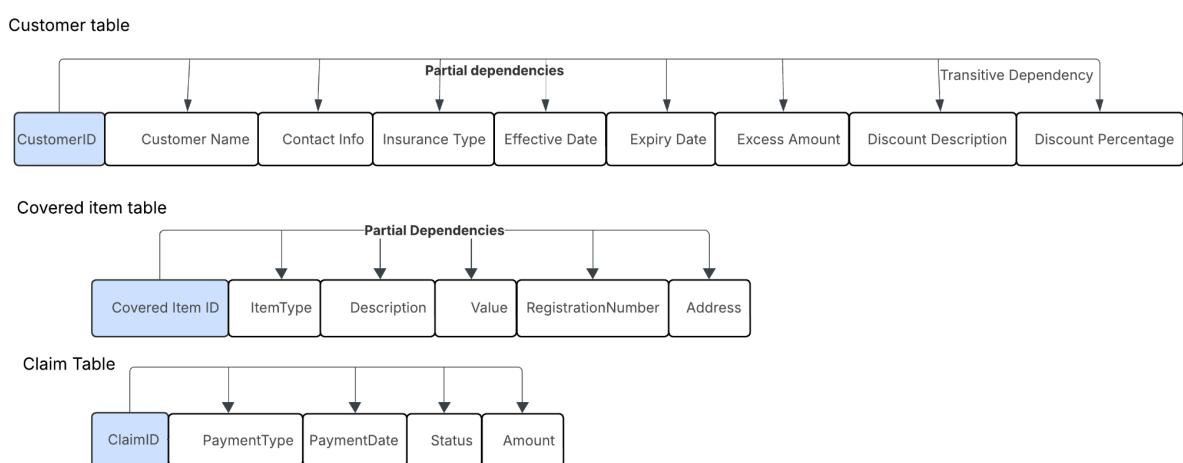


Figure 2: The second normal form dependency diagram of the AAMI company

The table is in Second Normal Form (2NF) and is already in First Normal Form (1NF) due to its atomic attributes and unique primary key. It has no partial dependencies, which means that no non-key attribute depends solely on a subset of a composite primary key. A partial dependency occurs when some attributes rely on only part of the primary key if the primary

key is composite. While your design meets the criteria for 2NF, it is important to recognize the potential anomalies that 2NF aims to prevent:

## Anomalies

- Insert Anomaly: If a non-key attribute that relies on only part of the key is missing, adding new data necessitates the inclusion of dummy or null values for those non-dependent attributes.
- Update Anomaly: Changing a non-key attribute that is dependent on only part of a composite key requires multiple updates across different tuples, which can lead to inconsistent data.
- Delete Anomaly: Removing a record that contains a non-key attribute dependent on part of the primary key may inadvertently eliminate information related to another component of the key.

Since your tables utilize single-column primary keys, these anomalies related to partial dependencies are naturally avoided. With 2NF already satisfied, the next step is to address transitive dependencies in order to achieve Third Normal Form (3NF).

## 3. 3NF (Third Normal Form)

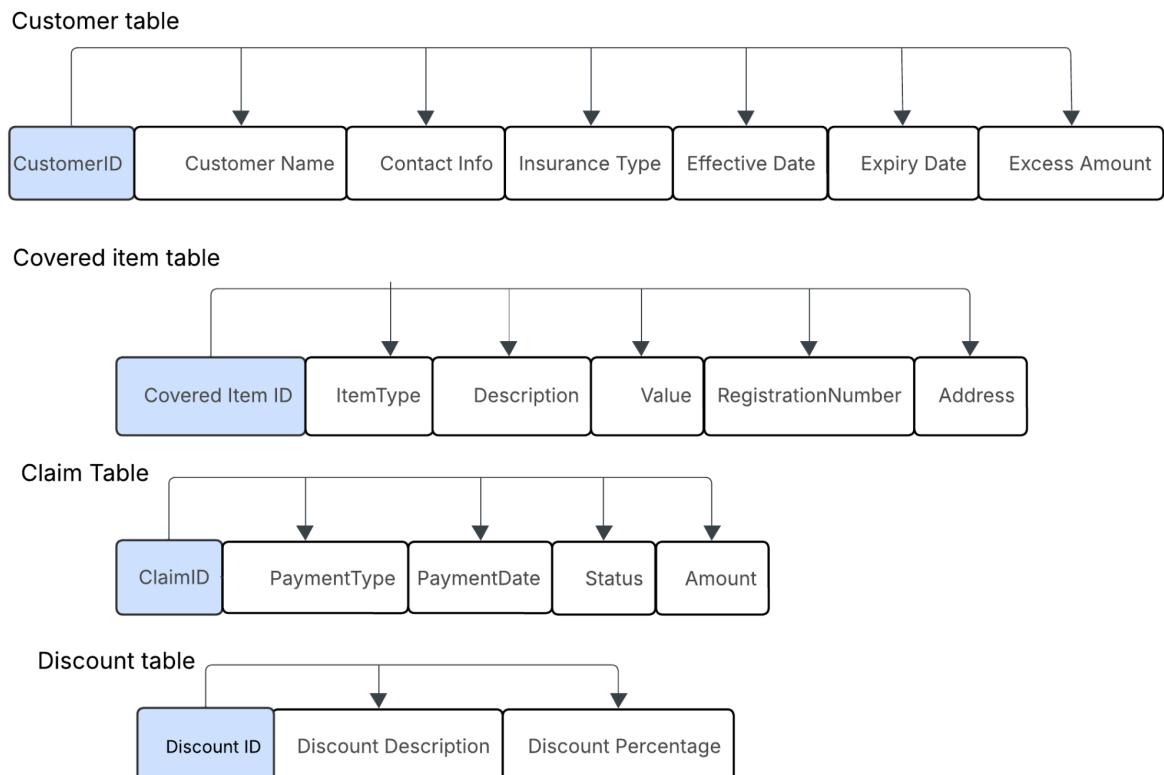


Figure 3: The third normal form dependency diagram of the AAMI company

Establishing a distinct Discount table within your database design is a crucial step to eliminate transitive dependencies, thereby addressing significant data anomalies and enhancing database maintenance. In accordance with the principles of Third Normal Form (3NF), all non-key attributes should be dependent solely on the primary key rather than on other non-key attributes. Storing discount information within the policy violates this principle, leading to redundancy and potential anomalies.

By designing a separate Discount table with DiscountID as its primary key, all attributes related to discounts can depend directly on DiscountID. The CustomerPolicy table merely references DiscountID as a foreign key, ensuring that all its attributes rely exclusively on its own primary key.

## Anomalies

- Insertion Anomaly:

Without a dedicated Discount table, it is impossible to record discount details unless there is a corresponding policy. However, with a separate Discount table, discount information can be entered independently without the immediate need to link it to a policy.

- Update Anomaly:

If discount details are repeated across multiple policies, updating that information (such as altering the percentage or description) necessitates changes to numerous records, which can lead to inconsistencies. A centralized Discount table allows for a single update, reflecting the change wherever the discount is utilized.

- Deletion Anomaly:

Deleting a policy may inadvertently remove discount information if it is stored within the same table, possibly resulting in the loss of discount data that remains pertinent to other policies. By keeping discount information separate, these details can persist independently of the policies.

### III. Entity Relationship Diagram for the company AAIM

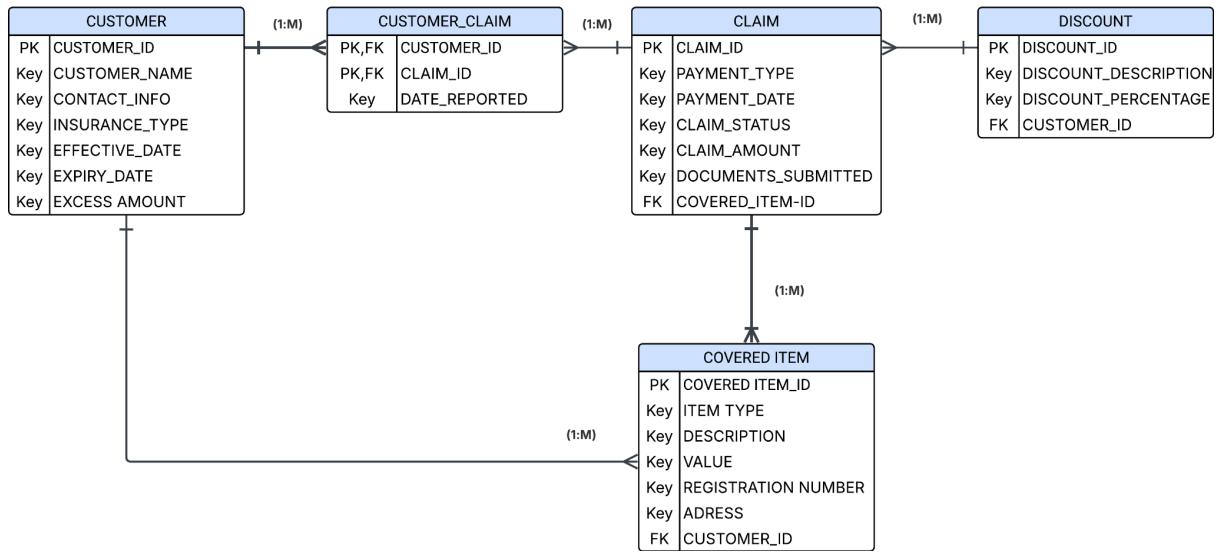


Figure 4: The ERD diagram of the AAMI company

The Entity-Relationship Diagram (ERD) incorporates the *CUSTOMER\_CLAIM* associative entity to effectively delineate the intricate relationships within the insurance sector. The introduction of the *CUSTOMER\_CLAIM* entity effectively addresses the many-to-many relationship between *Customer* and *Claim*, transforming it into two distinct one-to-many relationships. Specifically, each claim may involve one or multiple customers, while each customer may be associated with numerous claims, thereby reflecting realistic scenarios prevalent in insurance, such as joint claims or multiple insured parties.

The one-to-many relationship maintained between *Customer* and *Covered Item* highlights that each customer may insure multiple assets, with each covered item being uniquely owned by a single customer, thereby reinforcing clear asset ownership. Additionally, the relationship between *Covered Item* and *Claim* remains one-to-many, facilitating the possibility of multiple claims being lodged against the same asset due to various events or incidents over time.

Moreover, the relationship between *Claim* and *Discount* is structured as many-to-one, enabling multiple claims to share a single discount. This arrangement promotes efficient discount management and mitigates redundancy. It is noteworthy that participation in discounts is optional on the claim side, thereby recognizing that not all claims qualify for discounts.

Participation constraints have been rigorously applied so that every *Covered Item* must be linked to a *Customer*; each *Claim* must be associated with at least one *Customer* through the associate entity, and every *Claim* could reference a *Discount*, or have no discount at all. This ERD structure provides a normalized, scalable, and accurate representation of insurance business processes, thereby facilitating effective policy management, claims administration,

and customer relationship management while minimizing data redundancy and ensuring data integrity.

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