Phase III-a: Third Normal Form Normalization

Phase III-b: Dependency Diagrams

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1. PERSON

Schema: PERSON(PersonID, FName, MName, LName, Address, Gender, DateOfBirth)

FD: PersonID -> FName, MName, LName, Address, Gender, DateOfBirth

```
PersonID ---+---> FName
            +---> MName
            +---> LName
            +---> Address
            +---> Gender
            +---> DateOfBirth
```

- 1NF: Atomic values
- 2NF: Single-column PK
- 3NF: No transitive dependencies

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2. PHONE

Schema: PHONE(PersonID, PhoneNumber) **FK:** PersonID -> PERSON.PersonID

FD: {PersonID, PhoneNumber} -> (key-only table)

```
{PersonID, PhoneNumber} ---> (no non-key attributes)
```

- 1NF: Atomic values

- 2NF: No non-key attributes
- 3NF: No non-key attributes

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3. EMPLOYEE

Schema: EMPLOYEE(EmployeeID, StartDate, EType, TrainedByID) **FK:** EmployeeID -> PERSON.PersonID, TrainedByID -> TRAINER.TrainerID

FD: EmployeeID -> StartDate, EType, TrainedByID

```
EmployeeID ---+---> StartDate
              +---> EType
              +---> TrainedByID
```

- 1NF: Atomic values
- 2NF: Single-column PK
- 3NF: TrainedByID is FK, not transitive

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4. TRAINER

Schema: TRAINER(TrainerID) **FK:** TrainerID -> EMPLOYEE.EmployeeID

FD: TrainerID -> (key-only table)

```
TrainerID ---> (no non-key attributes)
```

- 1NF: Atomic values
- 2NF: No non-key attributes
- 3NF: No non-key attributes

---

5. MEMBER

Schema: MEMBER(MemberID, Level) **FK:** MemberID -> PERSON

FD: MemberID -> Level

```
MemberID ---> Level
```

- 1NF: Atomic values
- 2NF: Single-column PK

- 3NF: No transitive dependencies

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6. LIBCARD

Schema: LIBCARD(CardID, MemberID, IssueDate) **FK:** MemberID -> MEMBER.MemberID (UNIQUE constraint for 1:1)

FD: CardID -> MemberID, IssueDate

```
CardID ---+---> MemberID
          +---> IssueDate
```

- 1NF: Atomic values
- 2NF: Single-column PK
- 3NF: No transitive dependencies

---

7. GUEST (Weak Entity)

Schema: GUEST(GuestOfID, GuestID, Name, Address, ContactInfo) **FK:** GuestOfID -> MEMBER.MemberID

FD: {GuestOfID, GuestID} -> Name, Address, ContactInfo

```
{GuestOfID, GuestID} ---+---> Name
                        +---> Address
                        +---> ContactInfo
```

- 1NF: Atomic values
- 2NF: All attributes depend on full composite key
- 3NF: No transitive dependencies

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8. PROMO

Schema: PROMO(PromoCode, PromoDesc)

FD: PromoCode -> PromoDesc

```
PromoCode ---> PromoDesc
```

- 1NF: Atomic values
- 2NF: Single-column PK
- 3NF: No transitive dependencies

---

9. WITHPROMO (Junction Table)

Schema: WITHPROMO(CardID, PromoCode) **FK:** CardID -> LIBCARD.CardID, PromoCode -> PROMO.PromoCode

FD: {CardID, PromoCode} -> (key-only table)

```
{CardID, PromoCode} ---> (no non-key attributes)
```

- 1NF: Atomic values
- 2NF: No non-key attributes
- 3NF: No non-key attributes

---

10. PUBLISHER

Schema: PUBLISHER(PublisherID, PublisherName)

FD: PublisherID -> PublisherName

```
PublisherID ---> PublisherName
```

- 1NF: Atomic values
- 2NF: Single-column PK
- 3NF: No transitive dependencies

---

11. AUTHOR

Schema: AUTHOR(AuthorID, AuthorName)

FD: AuthorID -> AuthorName

```
AuthorID ---> AuthorName
```

- 1NF: Atomic values
- 2NF: Single-column PK
- 3NF: No transitive dependencies

---

12. BOOK

Schema: BOOK(BookID, PublisherID, BookTitle) **FK:** PublisherID -> PUBLISHER.PublisherID

FD: BookID -> PublisherID, BookTitle

```
BookID ---+---> PublisherID
          +---> BookTitle
```

- 1NF: Atomic values
- 2NF: Single-column PK
- 3NF: PublisherID is FK, not transitive

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13. WRITTENBY (Junction Table)

Schema: WRITTENBY(AuthorID, BookID) **FK:** AuthorID -> AUTHOR.AuthorID, BookID -> BOOK.BookID

FD: {AuthorID, BookID} -> (key-only table)

```
{AuthorID, BookID} ---> (no non-key attributes)
```

- 1NF: Atomic values
- 2NF: No non-key attributes
- 3NF: No non-key attributes

---

14. CATALOGS

Schema: CATALOGS(BookID, ManagerID, CatalogDate, Category) **FK:** BookID -> BOOK.BookID, ManagerID -> EMPLOYEE.EmployeeID

FD: {BookID, ManagerID, CatalogDate} -> Category

```
{BookID, ManagerID, CatalogDate} ---> Category
```

- 1NF: Atomic values
- 2NF: Category depends on full composite key
- 3NF: No transitive dependencies

---

15. REVIEW

Schema: REVIEW(BookID, PersonID, CommentTime, Content, Rating) **FK:** BookID -> BOOK.BookID, PersonID -> PERSON.PersonID

FD: {BookID, PersonID, CommentTime} -> Content, Rating

```
{BookID, PersonID, CommentTime} ---+---> Content
                                   +---> Rating
```

- 1NF: Atomic values
- 2NF: All attributes depend on full composite key
- 3NF: No transitive dependencies

---

16. BORROWED

Schema: BORROWED(BorrowedID, ReceptID, BookID, MemberID, IssueDate, DueDate) **FK:** ReceptID -> EMPLOYEE.EmployeeID, BookID -> BOOK.BookID, MemberID -> MEMBER.MemberID

FD: BorrowedID -> ReceptID, BookID, MemberID, IssueDate, DueDate

```
BorrowedID ---+---> ReceptID
              +---> BookID
              +---> MemberID
              +---> IssueDate
              +---> DueDate
```

- 1NF: Atomic values
- 2NF: Single-column PK
- 3NF: All FKs are direct references

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17. INQUIRY

Schema: INQUIRY(InquiryID, ReceptID, MemberID, InquiryTime, Status, Rating) **FK:** ReceptID -> EMPLOYEE.EmployeeID, MemberID -> MEMBER.MemberID

FD: InquiryID -> ReceptID, MemberID, InquiryTime, Status, Rating

```
InquiryID ---+---> ReceptID
             +---> MemberID
             +---> InquiryTime
             +---> Status
             +---> Rating
```

- 1NF: Atomic values
- 2NF: Single-column PK

- 3NF: No transitive dependencies

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18. PAYMENT

Schema: PAYMENT(PaymentID, BorrowedID, PaymentTime, Method, Amount) **FK:** BorrowedID -> BORROWED.BorrowedID (UNIQUE constraint for 1:1)

FD: PaymentID -> BorrowedID, PaymentTime, Method, Amount

```
PaymentID ---+---> BorrowedID
             +---> PaymentTime
             +---> Method
             +---> Amount
```

- 1NF: Atomic values
- 2NF: Single-column PK
- 3NF: No transitive dependencies

Summary

Table	Primary Key	1NF	2NF	3NF
PERSON	PersonID	Yes	Yes	Yes
PHONE	{PersonID, PhoneNumber}	Yes	Yes	Yes
EMPLOYEE	EmployeeID	Yes	Yes	Yes
TRAINER	TrainerID	Yes	Yes	Yes
MEMBER	MemberID	Yes	Yes	Yes
LIBCARD	CardID	Yes	Yes	Yes
GUEST	{GuestOfID, GuestID}	Yes	Yes	Yes
PROMO	PromoCode	Yes	Yes	Yes
WITHPROMO	{CardID, PromoCode}	Yes	Yes	Yes
PUBLISHER	PublisherID	Yes	Yes	Yes
AUTHOR	AuthorID	Yes	Yes	Yes
BOOK	BookID	Yes	Yes	Yes
WRITTENBY	{AuthorID, BookID}	Yes	Yes	Yes
CATALOGS	{BookID, ManagerID, CatalogDate}	Yes	Yes	Yes
REVIEW	{BookID, PersonID, CommentTime}	Yes	Yes	Yes
BORROWED	BorrowedID	Yes	Yes	Yes
INQUIRY	InquiryID	Yes	Yes	Yes
PAYMENT	PaymentID	Yes	Yes	Yes

All 18 tables are in 3NF.