**Database Design Principles**

**Team 4**

**19BCS027**

**19BCS014**

1,2) Schema of relations and key constraints:

Relation attributes key constraints

1. Reader: roll number – PK

Email – unique

First name

Last name

Type – CHECK student or staff

Address

1. PhoneNumbers: roll number – FK

Phone number - CHECK exact 10 digits, unique

1. Books: ISBN – primary key, check exact 13 or 10 digits

Title

Authno – Unique

Edition

Price

Category

1. returnDate : ISBN – PK

roll number - FK

return date

due date

renewal status – CHECK in renewed or not renewed

1. Publishes: ISBN – PK, FK

Publisher Id – FK

1. Publisher: Publisher ID – PK

Name

1. Login: Login ID – unique, FK

roll number – unique, FK

1. Authentication: Login ID – PK

Password – CHECK 8 – 25 characters must have alphabet and numeric

3,4,5) Functional Dependencies, Identify normal forms, normalise:

1) Reader(rollno, email, first name, last name, type, address)

FD:

Roll no -> roll no, email, first name, last name, type, address

Email -> roll no, email, first name, last name, type, address

Candidate keys: roll no, email

Prime attributes: roll no, email

Non-prime: first name, last name, type, address

Relation in 1NF since formed from schema, Relation in 2NF since there is no composite key, Relation in 3NF since no non-prime attributes are determiners.

2) Phone number(roll no, phone number)

FD:

No dependencies as both roll no and phone no required to uniquely find a row, Hence candidate key is roll no + phone no and relation is in 3NF

3) Books(ISBN, Title, authorno, edition, price, category)

FD:

ISBN -> ISBN, Title, authorno, edition, price, category

Title -> category

Title, edition -> price

Candidate keys: ISBN

Prime attributes: ISBN

Non-prime: Title, authorno, edition, price, category

Relation in 1NF since formed from schema, relation in 2NF since no composite candidate key, Relation not in 3NF as non-prime attribute title determines category and title and edition determine price.

Normalisation: split Book relation into 3 relations as below

Book (ISBN PK, title FK, edition FK, authno)

Edition (Title PK, edition PK, price)

Category (title PK, category)

Now all three decomposed tables are in 3NF as they were formed from 2NF table and have no transitive dependency

4) Return Date(ISBN, roll no, return date, due date, renewal status)

FD:

ISBN -> ISBN, roll no, return date, due date, renewal status

Candidate key: ISBN

Prime: ISBN non prime: roll no, return date, due date, renewal status

Relation in 1NF as it is from schema, In 2NF because no composite key, In 3NF because no non prime attribute determine any attributes.

5) Publishes(ISBN, publisher ID)

FD: ISBN -> ISBN, publisher ID

candidate key: ISBN

Prime: ISBN non prime: publisher ID

Relation in 1NF as from schema, In 2NF because no composite key, In 3NF because no non prime attribute determine any attributes.

6) Publisher(Publisher ID, name)

FD: publisher ID -> publisher ID, name

candidate key: publisher ID

Prime: publisher ID non prime: Name

Relation in 1NF as from schema, In 2NF because no composite key, In 3NF because no non prime attribute determine any attributes.

7) Login(login ID, roll no)

FD: login ID-> roll no, roll no-> login ID

Candidate key: login ID or roll no

Prime: login ID, roll no

Relation in 1NF as from schema, In 2NF because no composite key, In 3NF because no non prime attribute determine any attributes.

8)Authentication(login id, password)

FD: login id -> login id, password

Candidate key: login id

Prime: login id non-prime: password

Relation in 1NF as from schema, In 2NF because no composite key, In 3NF because no non prime attribute determine any attributes.