Database Systems I
CS3431
B-2011

Solution of Homework 2

Problem 1

```
Create Table Author(
        ID: integer Primary Key,
        Name: string Not NULL,
        DoB: date,
        Address: string,
);

Create Table Author_Phones(
        AuthorID: integer Foreign Key references Author(ID),
        Phone: char(10) Not NULL,
        Primary key (AuthorID, Phone)
);

Create Table Publisher(
        Name: string Primary Key,
        Phone: char(10),
        Address: string,
        startYear: integer
);


Create Table Book(
        ISBN: string Primary Key,
        Title: string Not NULL,
        Type: string Not NULL,
        NumPages: integer Not NULL,
        NovelSequelNum: integer,
        TextbookEdition: integer,
        PublisherName: string Foreign Key references Publisher(Name),
        PublishDate: date Not NULL
);


Create Table Author_Book(
        AuthorID: integer Foreign Key references Author(ID),
        BookISBN: string Foreign Key references Book(ISBN),
        Primary Key (AuthorID, BookISBN),
);
```

Create Table Contract (
AuthorID: integer Foreign Key references Author(ID),
PublisherName: string Foreign Key references Publisher(Name),
Date: date Not NULL,
NumBooks: integer Not NULL,
totalPayment: float Not NULL,
Primary Key (AuthorID, PublisherName, Date)
);

Create Table Contract_Lines (
AuthorID: integer,
PublisherName: string,
Date: date Not NULL,
LineNum: integer Not NULL,
BookType: string,
dueDate: date,
PartialPayment: float,
Foreign key (AuthorID, PublisherName, Date) references Contract (AuthorID, PublisherName, Date),
Primary Key (AuthorID, PublisherName, Date, LineNum)
);

Assumptions:

- For the ISA relationship, we chose to put all attributes in one relation since the number of attributes for "Novel" or "TextBook" is very few. Therefore, if a book is neither a novel nor a textbook, then the "sequel" and "edition" attributes will be nulls. Otherwise, one of them will have a value and the other is null depending on the book type.

Problem 2

Q1: Report the book titles and ISBN for the books written by author named "John Smith".

$R1 \leftarrow \pi_{BookISBN}\ (Author\_Book \bowtie_{AuthorID=ID}\ (\sigma_{Name= \text{“John Smith”}}(Author)))$

$Result \leftarrow \pi_{ISBN,\ title}\ (R1 \bowtie_{BookISBN=ISBN}\ (Book))$

Q2: Report the names and addresses of the authors and publishers who have contracts between "Jan-01- 2007" and "Dec-31-2008" with total payment above $100,000. Also report the contract date.

$R1 \leftarrow \sigma_{date>= \text{“Jan-01-2007”}\ \wedge\ date<= \text{“Dec-31-2008”}\ \wedge\ totalPayment\ >\ 100{,}000}(Contract)$

$R2 \leftarrow ((R1 \bowtie_{AuthorID=ID}\ (Author)) \bowtie_{publisherName=publisher.Name}\ (Publisher))$

$Result \leftarrow \pi_{AuthorID,\ Author.Name,\ publisher.Name,\ Author.address,\ publisher.Address,\ date}(R2)$

Q3: Report the publisher name that have published more than 10 books.

$\pi_{publisherName}\ (\sigma_{bookCnt\ >\ 10}\ (\gamma_{publisherName,\ bookCnt\ \leftarrow count(ISBN)}(Book)))$

Q4: Report the contracts (the author ID, publisher Name, and contract date) that have the sum of "partial payments" of the contact lines does not match the "total payment" defined in the contract.

$R1 \leftarrow \gamma_{AuthorID,publisherName,Date,\ SumPayment\ \leftarrow sum(partialPayment)}(Contract\_Lines)$

$Result \leftarrow \pi_{\ AuthorID,publisherName,Date}\ (\sigma_{totalPayment<>SumPayment}\ (R1 \bowtie (Contract)))$

Problem 3

1. $R \bowtie S$

Min = 0 Max = nm

2. $\sigma_p(R) \times S$, for some predicate ***p*** and assume $\varnothing \times S = S$, where $\varnothing$ is an empty relation.

Min = m Max = nm

3. $\pi_l(R) - S$, for some list of attributes ***l,*** and assume that the difference operation is valid.

Min = 0 Max = n