

Problem 1

```
CREATE TABLE Students (  
    StudentID int NOT NULL,  
    Name string NOT NULL,  
    Address string NOT NULL,  
    Gender string NOT NULL  
    GPA decimal NOT NULL DEFAULT 0,  
    Major string NOT NULL  
    Minor string NULL,  
    PRIMARY KEY (StudentID),  
    CHECK (Gender IN ('Male', 'Female'))  
);
```

```
CREATE TABLE Courses (  
    CourseID int NOT NULL,  
    Title string NOT NULL,  
    CreditNumber decimal NOT NULL,  
    PRIMARY KEY (CourseID)  
);
```

```
CREATE TABLE CourseRegistration (  
    CourseRegistrationID int NOT NULL,  
    Semester string NOT NULL,  
    StudentID int NOT NULL,  
    CourseID int NOT NULL,  
    Grade decimal NOT NULL,  
    FOREIGN KEY (StudentID) REFERENCES Students(StudentID),  
    FOREIGN KEY (CourseID) REFERENCES Courses(CourseID)  
);
```

Problem 2

ContractLines(LineNum, ContractID, BookType, dueDate, PartialPayment)

Contracts(ContractID, PublisherID, ID, Date, totalPayment, NumBooks)

Publishers(name, phone, address, StartYear)

Authors(ID, address DoB, name)

AuthorPhones(Number, ID)

Books(ISBN, PublisherID, title, type, NumPages, PublishDate)

Writes(ID, ISBN)

Foreign key: ContractLines.ContractID references Contracts.ContractID

Foreign key: Contract.PublisherID references Publishers.PublisherID

Foreign key: Contract.ID references Authors.ID

Foreign key: AuthorPhones.ID references Authors.ID

Foreign key: Books.PublisherID references Publishers.PublisherID

Foreign key: Writes.ID references Authors.ID

Foreign key: Writes.ISBN references Books.ISBN

Problem 3

| | |
|---------------------|-------------------------------|
| $AB \rightarrow D$ | Transitivity |
| $C \rightarrow A$ | Transitivity |
| $DB \rightarrow C$ | Augmentation and Transitivity |
| $AB \rightarrow CD$ | Transitivity |
| $C \rightarrow AD$ | Transitivity |

Problem 4

Keys are listed from Minimal to Maximal candidate keys, with the last being the trivial candidate key.

$R(A, B, C, D)$: $AB \rightarrow C$, $C \rightarrow D$ and $D \rightarrow A$

Candidate Keys: AB, BC, BD, ABC, ABD, ACD, BCD, ABCD

$R(A, B, C, D)$: $AB \rightarrow C$, $BC \rightarrow D$, $CD \rightarrow A$ and $AD \rightarrow B$

Candidate Keys: ABC, ABD, ACD, BCD, ABCD

$R(A, B, C, D, E)$: $AB \rightarrow C$, $C \rightarrow D$, $D \rightarrow B$ and $D \rightarrow E$

Candidate Keys: AB, AC, AD, ABC, ABD, ABE, ACD, ACE, ADE, ABCD, ABCE, ABDE, ACDE, ABCDE