**CS542: Homework 2**

## Problem 1 (Relational Model) [15 Points]

Create a Relational Model (the CREATE TABLE statements) for the following database:

- We have students; each student has a unique Id, name, address, gender, and overall GPA (has default value of 0).
- Each student must have one major (mandatory attribute) and optionally one minor.
- The model must check that the gender takes values either "Male" or "Female"
- We have courses, each course has a unique CourseId, title, and number of credits
- Students will register in courses in certain semesters. We need to keep track of the grade that a student has received in a given course. The model should allow a student to take the same course in different semesters.

Your CREATE TABLE statements should clearly indicate the following: 1) The attribute names and their data types (choose appropriate types), 2) The primary keys in each table, 3) The NULL (or NOT NULL) and the DEFAULT constraints, 4) The CHECK domain constraints and 5) The foreign key constraints.

## Problem 2 (Mapping from Entity-Relationship Model to Relational Model) [15 Points]

Map the ERD given in Figure 1 (see next page) to the corresponding relational model. In the relational model, you should provide:

- For a given relation (say R) with attributes A1, A2, ...An, represent R as follows:
  *R(A1, A2, ..., An) and underline the primary key attribute(s)*
- State the foreign key relationships. If a foreign key R.A1 (i.e., column A1 from relation R) references the primary key S.B1 (i.e., column B1 from relation S), then represent that as follows:
  *Foreign key: R.A1 references S.B1*

Note: For this problem, you are not asked to write Create Table statements nor to define data types.

## Problem 3 (Functional Dependency) [10 Points]

Consider a relation with schema R(A, B, C, D) and FD's: AB → C, C → D, and D → A. List five FD's that can be derived from the given FD's. Use the functional dependency properties like Transitivity, Augmentation, etc.

## Problem 4 (Functional Dependency) [10 Points]

For each relational schema given below and its corresponding functional dependencies (FDs), find all candidate keys of the relation. Use the functional dependency properties like Transitivity, Augmentation, etc.

• R(A, B, C, D): AB → C, C → D and D → A
• R(A, B, C, D): AB → C, BC → D, CD → A and AD → B
• R(A, B, C, D, E): AB → C, C → D, D → B and D → E

**Deliverables:**

Each student should deliver a report containing the required solution. Your final **submission must be uploaded to Canvas in pdf format.**

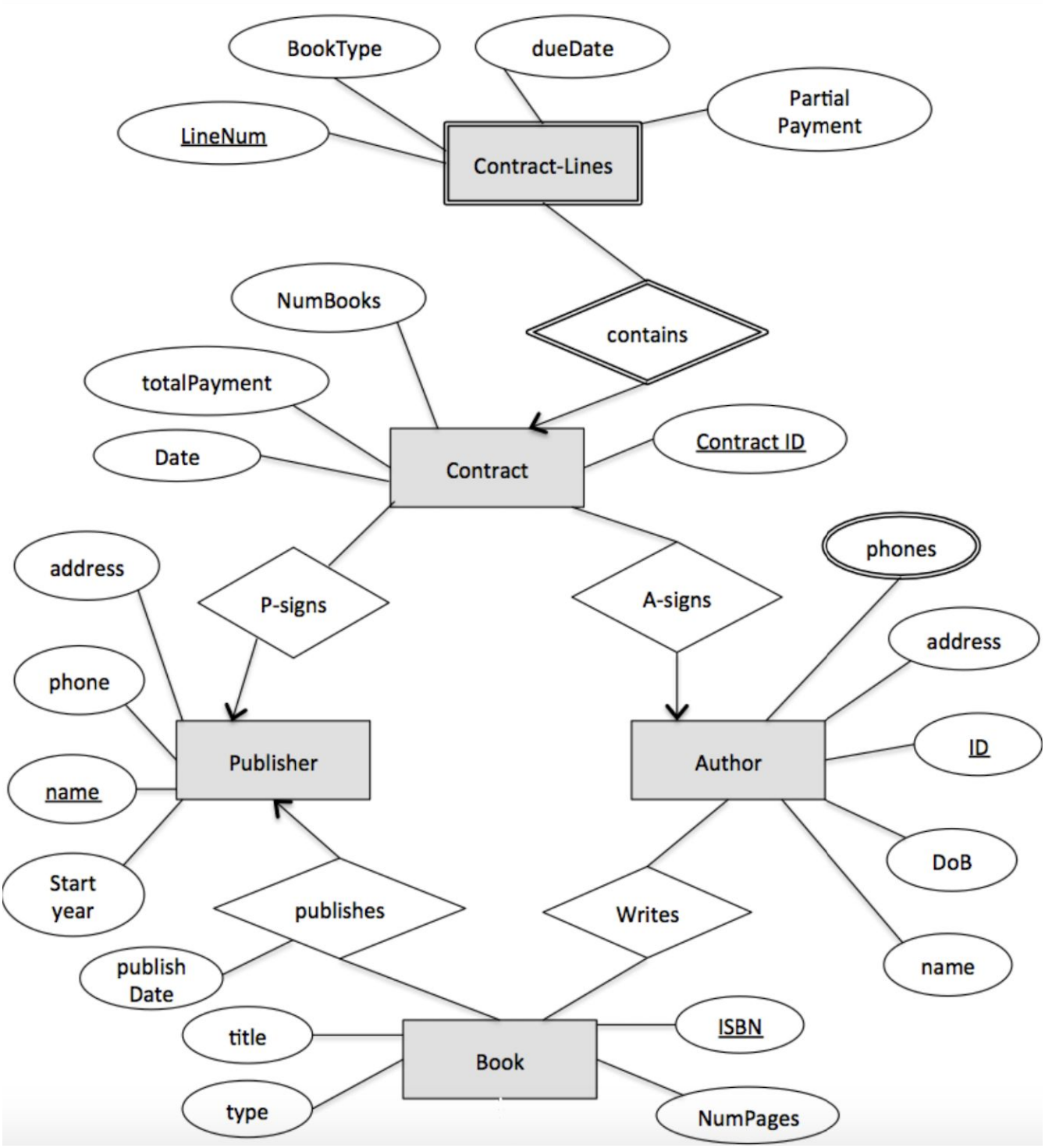
BookType
dueDate
Partial Payment
LineNum
Contract-Lines
NumBooks
contains
totalPayment
Date
Contract
Contract ID
address
P-signs
A-signs
phones
address
phone
Publisher
Author
ID
name
DoB
Start year
publishes
Writes
name
publish Date
title
Book
ISBN
type
NumPages

Figure 1