ER Modeling Worksheet Weighting 5%

Question 1 Library System

Assume there is a library system with the following properties.

- The library contains one or several copies of the same book.
- Every copy of a book has a copy number and is located at a specific location in a shelf.
- A copy is identified by the copy number and the ISBN number of the book.
- Every book has a unique ISBN, a publication year, a title, an author, and a number of pages.
- Books are published by publishers
- A publisher has a name as well as a location.
- Within the library system, books are assigned to one or several categories.
- A category can be a subcategory of exactly one other category.
- A category has a name and no further properties.
- Each reader needs to provide his/her family name, his/her first name, his/her city, and his/her date of birth to register at the library.
- Each reader gets a unique reader number.
- Readers borrow copies of books. Upon borrowing the return date is stored.

1. Produce an entity relationship (ERD) diagram for the library system. Clearly indicate each of the following:

• All entities
• Use the 9 step process discussed in class
• Show each step in your submission
• Degree, cardinality and participation of relationships
• Attributes
• Both weak and strong entities and their relationships

Chen's ERD – Entity Representation Diagram Process
Library System

Step One - Identify Entities (List all potential entity types)

1. Library
2. Books
3. Copy of books
4. Location of Shelf
5. Publisher
6. Categories
7. Subcategories
8. Reader
9. Author
10. Staff
11. Borrowed books (Library Book Loans)

Step 2 - Remove duplicate entities and don't include the system as an entity type.

1. Books
2. Publisher
3. Categories
4. Reader
5. Library Book Loans

Step 3 - List the attributes of each entity

1. Books
    - Unique ISBN
    - Copy Number
    - Publication Year
    - A Title
    - Author
    - Number of pages
    - Shelf location
2. Publisher
    - Publisher ID
    - First name
    - Surname
    - Location
3. Categories
    - Name
4. Reader
    - Reader ID
    - First name
    - Family name
    - City
    - Date of birth
5. Library Book Loans
    - Loan date and Return date

Step 4 - Mark the primary keys

1. Books
    - Unique ISBN **(Composite Primary Key)**
    - Copy Number **(Composite Primary Key)**
    - Publication Year
    - A Title
    - Author
    - Number of pages
    - Shelf location
2. Publisher
    - Publisher ID **(Primary Key)**
    - First name
    - Surname
    - Location
3. Categories
    - Name
4. Reader
    - Reader ID **(Primary Key)**
    - First name
    - Family name
    - City
    - Date of birth
5. Library Book Loans
    - Loan date
    - Return date

Step 5 • Define relationships of Entities (Strong and Weak entities)

Define relationships of Library System Entities.

A **strong entity** always has the primary key.
A **weak entity** is an entity that cannot be uniquely identified by its attributes alone.

1. Books **(Strong Entity)**
2. Publisher **(Strong Entity)**
3. Categories**(Weak Entity)**
4. Reader**(Strong Entity)**
5. Library Loans**(Weak Entity)**

- **[Books]** *are* **<published>** by **[Publisher]**
- **[Books]** are **<assigned>** by several **[[Categories]]**
- **[Books]** are **<borrowed>** by **[Readers]**
- **[[Library Book Loans]] <involves> [Books]**
- **[[Library Book Loans]] <involves> [Readers]**

Step 6 Describe the cardinality of the relationships.

[Books] **M**------ <Publish by> ------ **1** [Publisher] **(M: 1)**

[Books] **1**------ <Assign by> ------ **M** [[Categories]] **(1: M)**

[Books]**M**------ <Borrow by> ------ **M** [Readers] **(M: N)**

[[Library Book Loans]] **1**----< involves >--- **M** [Books] **(1: M)**

[[Library Book Loans]] **1**---< involves >---- **M** [Readers] **(1: M)**

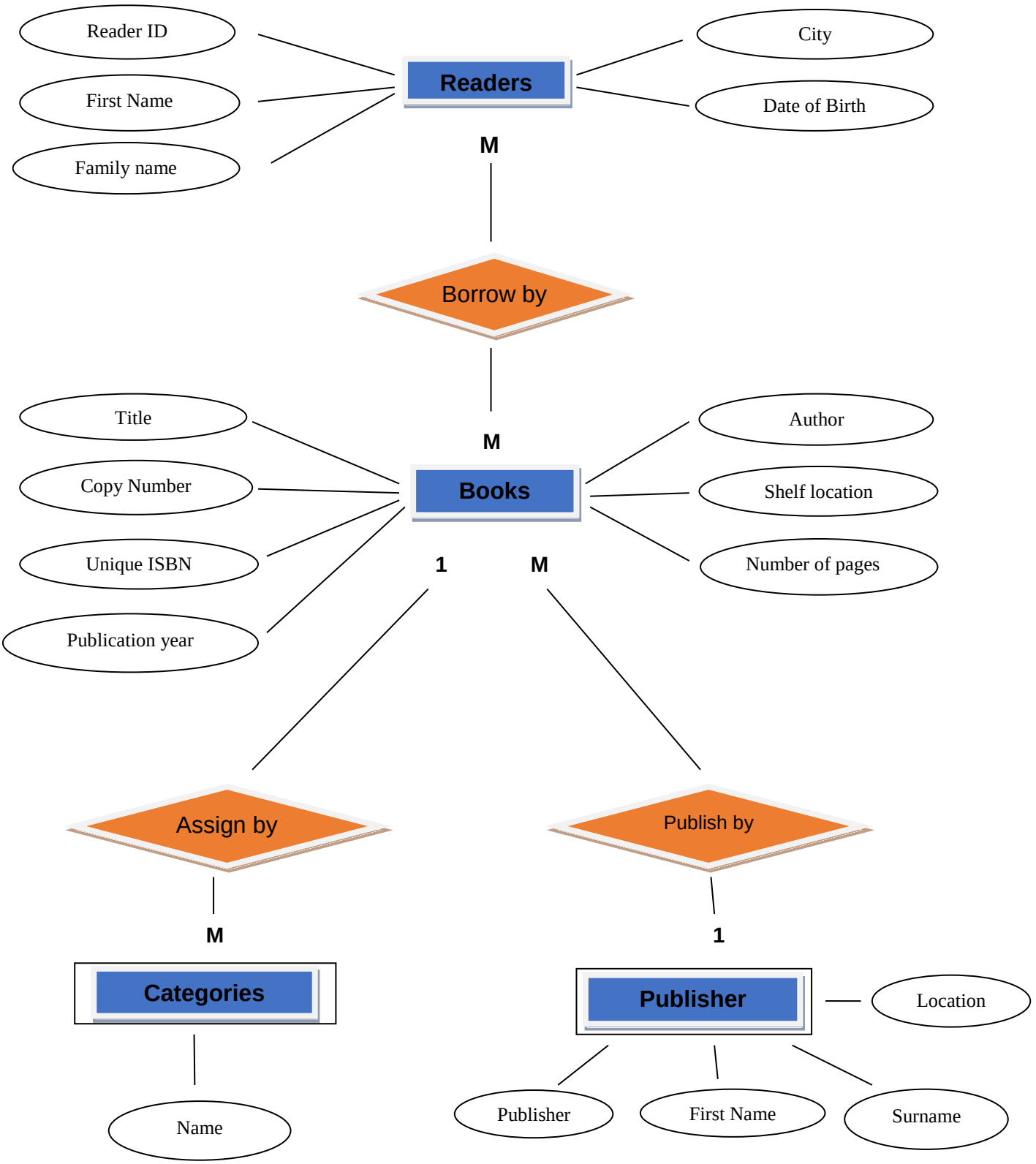
Step 7 Remove redundant relationships if necessary

[Books] **M**------ <Publish by> ------ **1** [Publisher] **(M: 1)**

[Books] **1**------ <Assign by> ------ **M** [[Categories]] **(1: M)**

[Books]**M**------ <Borrow by> ------ **M** [Readers] **(M: N)**

Step 8 Combine into single diagram. (All entities and the relationships between them should be combined.)



Step 9 Turn many to many relationships into 1 -M and M-1.