CS2312 Example Sheet 4 (Answers)

Question 1

Discuss the following terms from Extended-Entity-Relationship (EER) modelling. Show how each of the elements you describe is drawn in an EER model.

i. *Entity types*. What is an entity type? What is the difference between a strong entity type and a weak entity type?

> **Group of "objects" (real or abstract) with the same properties and having an independent existence. Strong = not dependent on some other entity type for its existence. Weak = dependent on some other entity type for its existence.**

ii. *Relationship type*. What is a relationship type? What is the degree of a relationship type? What is a recursive relationship?

> **A set of meaningful associations among entity types. Degree = number of participating entity types. Recursive = same entity participates more than once in different roles.**

iii. *Attributes*. What is an attribute? What is an attribute domain? What is a derived attribute? What is a discriminator attribute? What is the difference between simple attributes and composite attributes and the difference between single-valued attributes and multi-valued attributes?

> **Property of an entity or relationship type. Domain is set of allowable values. Simple has single independent component, composite made up of multiple independent components. Derived is derivable from value(s) of related attribute(s), not necessarily of same entity. Discriminator is used to distinguish instances of a weak entity type (part of composite primary key). Single-valued has only one value for each instance of entity type, multi-valued may have more than one.**

iv. *Keys*. What is the difference between a candidate key, a primary key and a composite key? What considerations might influence the choice of a primary key?

> **Candidate is minimal set of attributes that uniquely identifies instances of entity. Primary is selected candidate key. Composite is candidate consisting of more than one attribute.**

Question 2

A library service wants to create a database to store details of its libraries, books and borrowers. Details include the following:

A book has a unique ISBN number, a title and one or more authors. The library service may own several copies of a given book, each of which is located in one of the service's libraries. A given library contains many books, and in order to distinguish different copies of the same book a library assigns a different copy-number to each of its copies of a given book; the price that was paid for each copy is also recorded. Every library has a unique name and is either a main library or a branch library. A main library may have zero or more branch libraries and every branch library is a branch of exactly one main library. A borrower has a name and a unique ID code. A borrower can have many books on loan, but each copy of a book can only be on loan to one borrower. A borrower could borrow the same book on several occasions, but it is assumed that each such loan will take place on a different date.
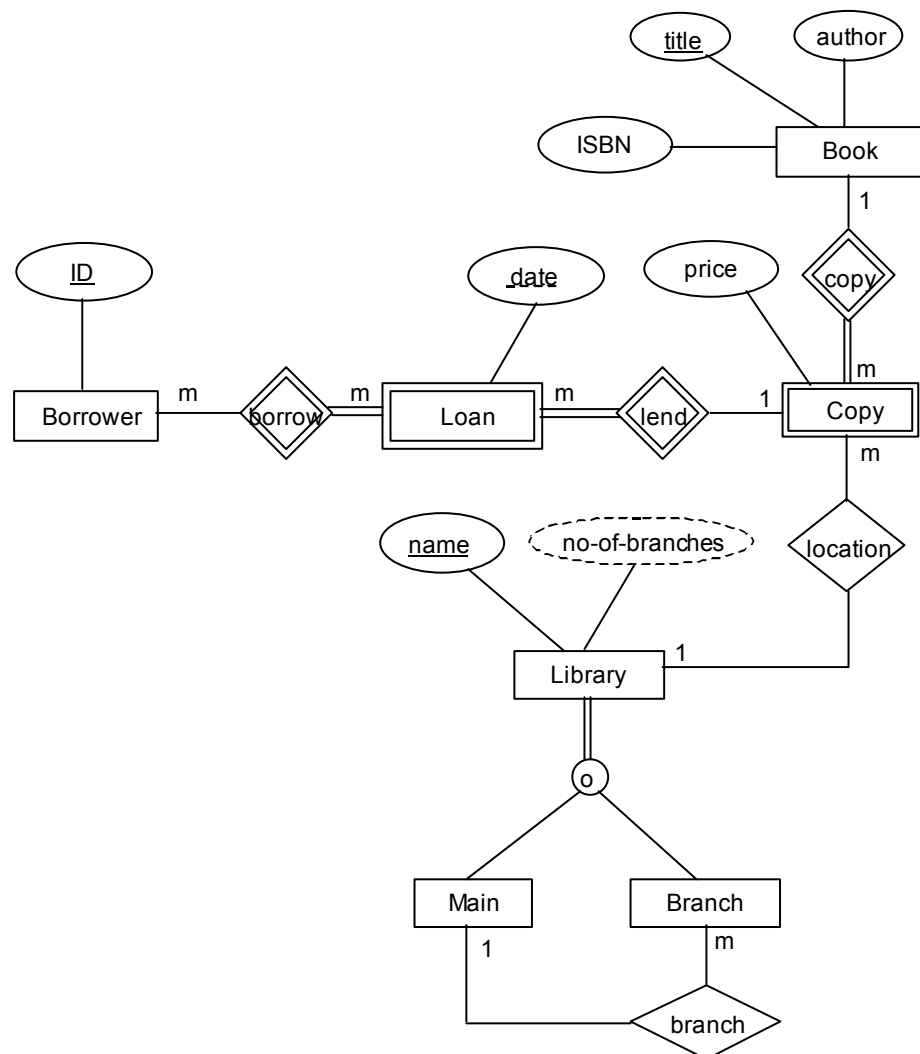

Figure 2

Figure 2 illustrates a preliminary design of an Extended-Entity-Relationship model intended to meet the above specification. The design contains at least 10 errors. Describe each error, clearly stating both the nature of the problem and its solution, and draw a corrected EER model.

1. *author should be a multivalued attribute.*
2. *location should be an identifying relationship.*
3. *Copy should have total participation in location.*
4. *a Loan can have only 1 Borrower.*
5. *number should be a discriminating attribute for Copy.*
6. **Branch should have total participation in the branch relationship.**
7. **no-of-branches should be an attribute on Main not Library.**
8. **specialisation of Library should be disjoint.**
9. **Borrower should have a name attribute.**
10. **ISBN should be the key of book, not name.**
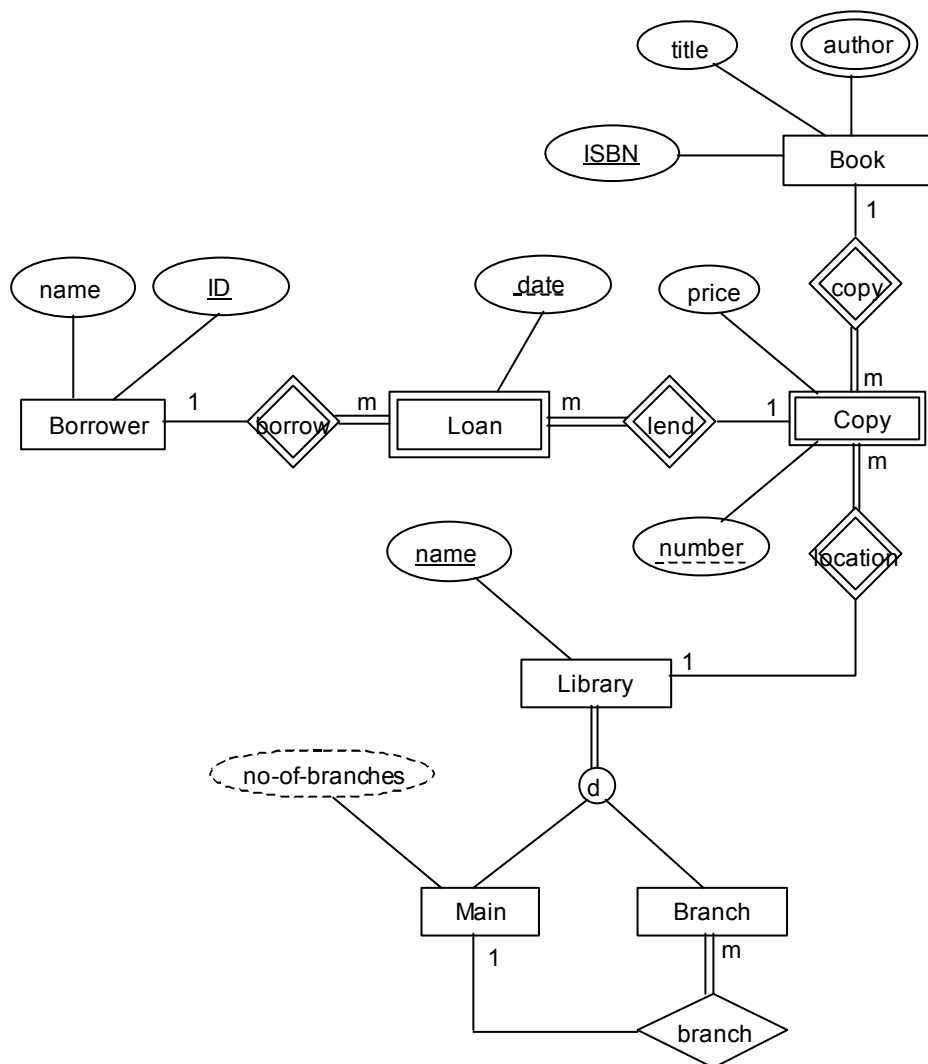

Figure 2

Question 3

Figure 3 shows a fragment of an Extended-Entity-Relationship model describing customer orders.
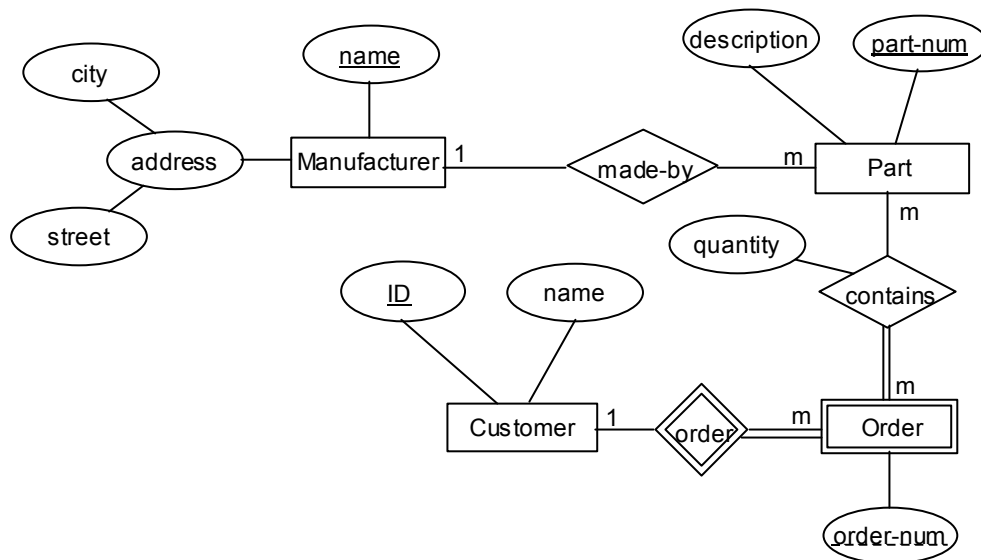

Figure 3

Map the EER model into a relational schema, clearly indicating all primary and foreign keys (also stating into which relations they are keys).

Manufacturer(***name, city, street***)
Part(***part-num, description, manufacturer***)
                    manufacturer is FK to Manufacturer
Customer(***ID, name***)
Order(***customer, order-num***)
                    customer is FK to Customer
Contains(***customer, order-num, part-num, quantity***)
                    customer, order-num is FK to Order
                    part-num is FK to Part

Question 4

A record company wishes to use a computer database to help with its operations regarding its performers, recordings and song catalogue. A requirements analysis has elicited the following information:

- Songs have a unique song number, a non-unique title and a composition date. A song can be written by a number of composers; the composer's full name is required. Songs are recorded by recording artists (bands or solo performers). A song is recorded as a track of a CD. A CD has many songs on it, called tracks. CDs have a unique record catalogue number, a title and must have a producer (the full name of the producer is required). Each track must have the recording date and the track number of the CD.
- A song can appear on many (or no) CDs, and be recorded by many different recording artists. The same recording artist might re-record the same song on different CDs. A CD must have only 1 recording artist appearing on it. CDs can be released a number of times, and each time the release date and associated number of sales is required.

Use this information to design an appropriate EER model.

There are many possible "correct" answers to this question (I have seen at least six, plus innumerable minor variations) – remember that EER modeling is not an exact science. If in doubt about your own design, ask one of us about it in an examples class.