Roll Number:

CS4.301: Data and Applications (Monsoon 2024)

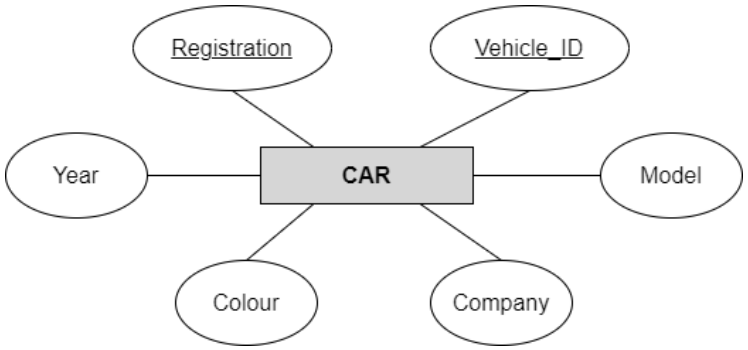
Quiz 2

Maximum Marks: 20, Time: 45 minutes

- **Keep answers concise. State all assumptions.**
- **All questions are compulsory.**

Question 1

Using the entity type described below, answer the following questions. (Assume that if two attributes are underlined separately, then each is a key on its own)



(2+3+3)

a. **Which of the following can be a superkey of the entity type depicted above?**

   . **{Year, Colour}**

   . **{Vehicle_ID, Registration}**

   . **{Vehicle_ID, Model, Company}**

   . **{Registration, Year, Colour, Company}**

b. Calculate the number of possible superkeys and show your steps with relevant reasoning.

c. Differentiate between super key, candidate key and primary key.

- Options ii, iii, iv are correct. Start with 2 marks, -1 if incorrect option (i) is selected, and -0.5 for each correct option not selected
- Answer is 48 --- 1 mark for only the answer, full marks (3) for answer and steps. 2 marks if steps are there but answer is incorrect.

Total number of subsets = 2^6-1= 63
Total number of subsets without both primary keys = 2^4-1 = 15
Number of subsets with atleast one primary key = 63-15 = 48

- 1 mark for each pair where the difference is evident. It doesn't have to be a table or explicit pairwise difference.

Question 2

Consider the following six relations for an order-processing database application in a company. (Assume that if multiple attributes are underlined under the same schema, they together form a key)

(3)

CUSTOMER (Cust#, Cname, City)
ORDER (Order#, Odate, Cust#, Ord_Amt)
ORDER_ITEM (Order#, Item#, Qty)
ITEM (Item#, Unit_price)
SHIPMENT (Order#, Warehouse#, Ship_date)
WAREHOUSE (Warehouse#, City)

Here, Ord_Amt refers to the total dollar amount of an order; Odate is the date the order was placed; and Ship_date is the date an order (or part of an order) is shipped from the warehouse. Assume that an order can be shipped from several warehouses. **Specify the foreign keys for this schema, stating any assumptions you make.**

1. 0.5 if name of key, where it is primary key and where it is foreign key, mentioned

   0.25 if name of key is mentioned but either of the two: where it is primary key and where it is foreign key are missed

2. 0.5 if none of the primary and foreign keys are swapped (i.e. they know where the key is a foreign key and where its a primary key)

   0 here if they've swapped the order for any key

Total possible = 5*0.5 + 0.5 if everything's correct

Answer:
Strictly speaking, a foreign key is a *set* of attributes, but when that set contains only one attribute, then that attribute itself is often informally called a foreign key. The schema of this question has the following five foreign keys:

1. the attribute Cust# of relation ORDER that references relation CUSTOMER,
2. the attribute Order# of relation ORDER_ITEM that references relation ORDER,
3. the attribute Item# of relation ORDER_ITEM that references relation ITEM,
4. the attribute Order# of relation SHIPMENT that references relation ORDER, and
5. the attribute Warehouse# of relation SHIPMENT that references relation WAREHOUSE.

Question 3

Map the given relational schema into an ER diagram. This is part of a process known as *reverse engineering*, where a conceptual schema is created for an existing implemented database. State any assumptions you make. (Assume that if multiple attributes are underlined under the same schema, they together form a key for that schema)

(6)

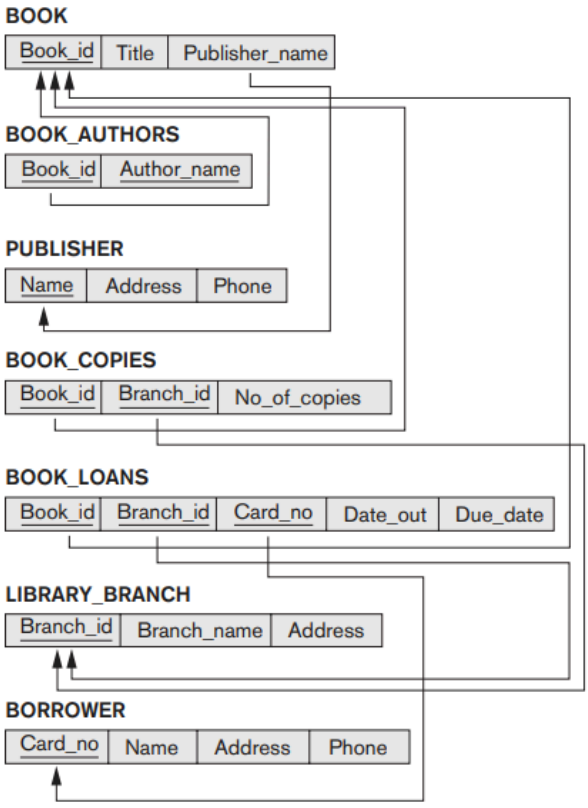


Figure 6.6
A relational database schema for a LIBRARY database.

BE AS STRICT AS POSSIBLE, THIS IS THE ONLY QUESTION TO INDUCE A GRADIENT IN SCORES (it was meant to be tough anyways)

Keep deducting the following out of 6:

-0.5 for each arrow missed

-0.5 for attribute missed (max -1 for all mistakes combined)

-0.5 for demarcation (max -1 for all mistakes combined)

-0.5 for making book authors strong entity or a relationship

(Justification: Book authors clearly has a dependency to Book. One of its key attributes, is a primary key for book, so in conceptual modelling, it shouldn't be a strong entity.

They also shouldn't make book authors into a relationship(b/w book and a new entity, authors) since a separate schema called 'authors' isn't mentioned explicitly, defeating the purpose of reverse engineering. If it was this way, the schema would've looked very different)

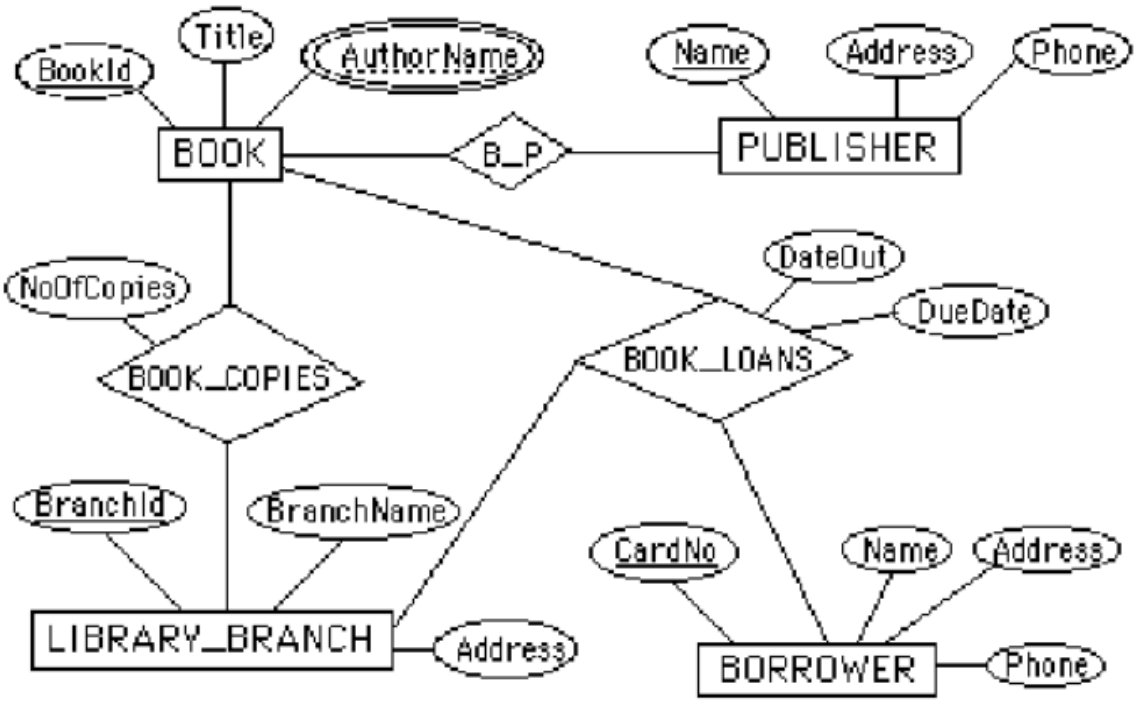
-1 each for making Book_Copies/ Book_Loans strong entities

-0.5 each for making Book_Copies/ Book_Loans weak entities (if no justification is mentioned in assumptions)

(Justification: All their primary keys are foreign keys, so it's clearly either a relationship or a weak entity. Modelling a relationship as a weak entity would require an explanation of design choice. Also because they would now be defining new relationships for this weak entity, not modelling it as a relationship to begin with is not obvious)

9.3 - Try to map the relational schema of Figure 6.14 into an ER schema. This is part of a process known as reverse engineering, where a conceptual schema is created for an existing implemented database. State any assumptions you make.

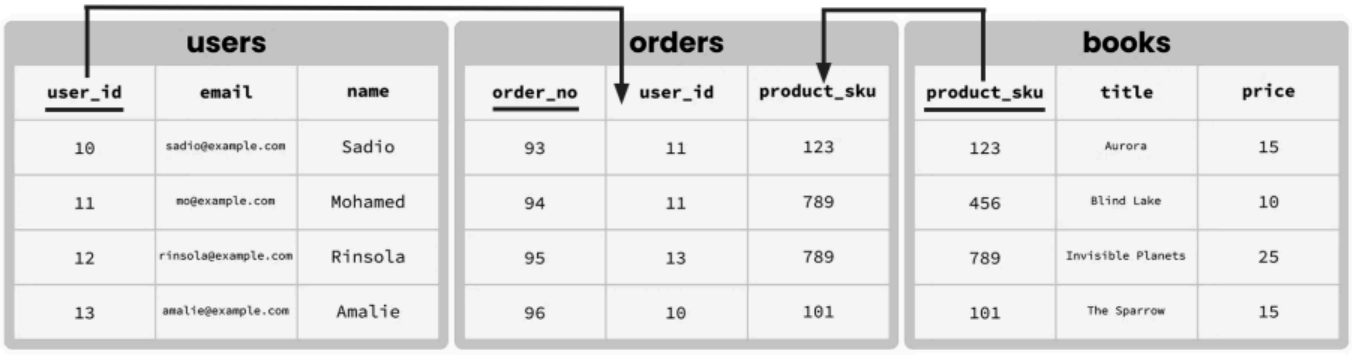
Answer:



Note: We represented BOOK_AUTHORS as a multi-valued attribute of BOOK in the above ER diagram. Alternatively, it can be represented as a weak entity type.

Question 4

For the given relational database schema, the referential integrity constraints and its initial state is given below. Populate the relations further with few relevant sample tuples to give examples of the following.



users

user_id	email	name
10	sadio@example.com	Sadio
11	mo@example.com	Mohamed
12	rinsola@example.com	Rinsola
13	amalie@example.com	Amalie

orders

order_no	user_id	product_sku
93	11	123
94	11	789
95	13	789
96	10	101

books

product_sku	title	price
123	Aurora	15
456	Blind Lake	10
789	Invisible Planets	25
101	The Sparrow	15

a) One INSERT that violates key constraint
b) One INSERT that violates entity integrity constraints
c) One DELETE on orders that violates referential integrity constraints
d) One DELETE on orders that is acceptable
e) One UPDATE on users that is acceptable
f) One UPDATE on users that violates domain constraints

(3)

0.5 mark for each part

Total = 0.5*5 + 0.5 (part c is grace) = 3