CS354 MIDSEM

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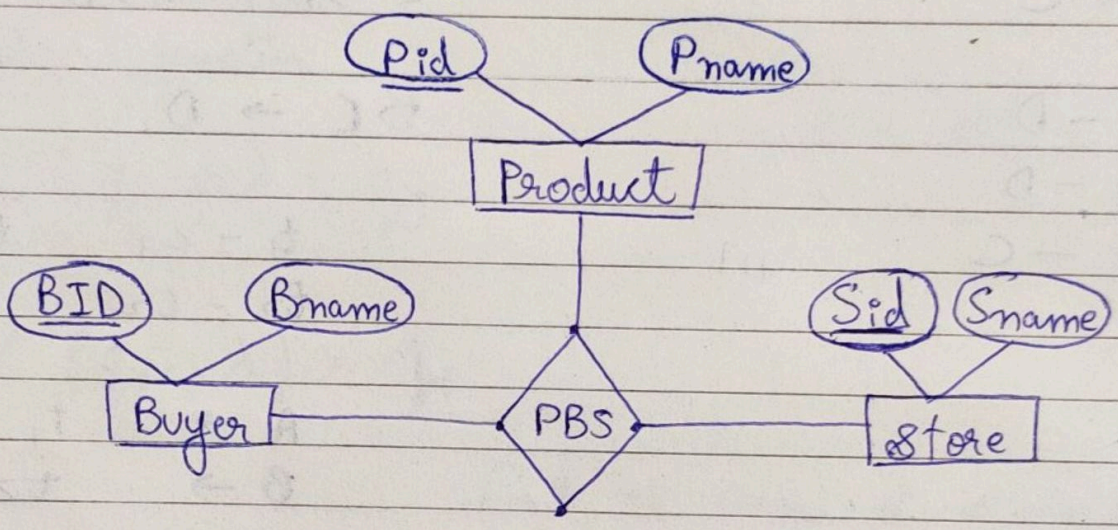
Q6

sol Given: Two different ER models for representing relationships between Products, buyers and stores.

Case 1: PBS using ternary relationship



:- This ER model represents a PBS ternary relationship with Buyer (with primary key as Bid), Product (with primary key as Pid) and store (with primary key as Sid). It is many-to-many-to many relation.

:- PBS will contain only key attributes of participating entities as its own attributes, namely :- Bid, Pid and Sid.

:- The primary key of PBS = Union of keys of (entities) ∴ combination of (Bid Pid and Sid) is the key.

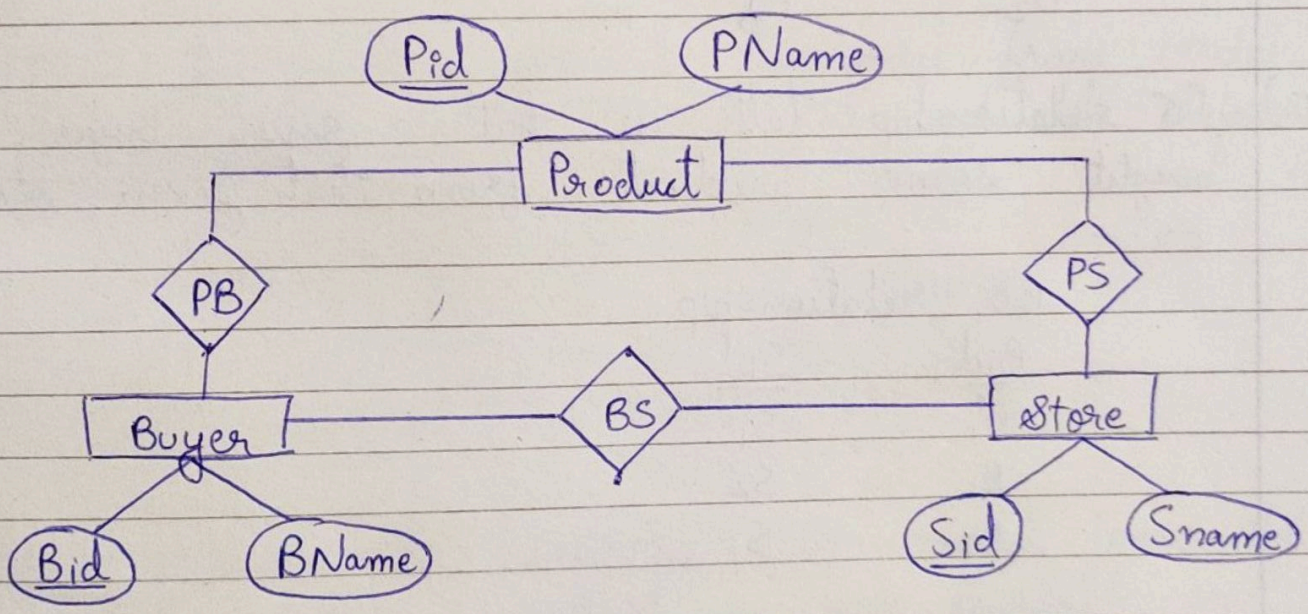
:- This gives us information about a particular buyer who bought a particular product from particular store.

For ex :-

PBS relationship

	Bid	Pid	Sid	(buyer) (Product) (store)
1	B_1	P_1	S_1	$\Rightarrow$ (B_1 bought P_1 from S_1)
2	B_2	P_2	S_1	
3	B_1	P_3	S_2	
	B_1	P_1	S_1	× Similar to tuple 1, hence not allow
4	B_2	P_4	S_2	

Case 2 : PBS using binary relationships



:- This ER model represents relationships between Product (with primary key as Pid), Store (with primary key as Sid) and Buyer (with primary key as Bid) using binary relationships between them.

:- All relationships are many-to-many and contain only key attributes of participating entities as their own attributes i.e =>

- PB has { Bid, Pid } with primary key { Bid Pid }
- BS has { Bid, Sid } with primary key { Bid Sid }
- PS has { Pid, Sid } with primary key { Pid Sid }

This ER model gives us following information :-

1.) PB relationship tells us that a given buyer has bought some particular products

Ex:-

PB relationship

Bid	Pid
B_1	P_1
B_1	P_2
B_2	P_3

(Thus B_1 bought P_1 & P_2 while B_2 bought P_3)

2.) BS relationship tells us that a given buyer has bought some product from that given store

Ex:-

BS relationship

Bid	Sid
B_1	S_1
B_1	S_2
B_2	S_1

3.) PS relationship tells us that a given product was sold / available in a given store

Ex:-

PS relationship

Pid	Sid
P_1	S_2
P_2	S_1

Comparisons / Limitations of the two models

Let PBS model with ternary relation be called model "TR" and PBS model with binary relations be called "BR".

1) Model "TR" explicitly did not give any information between (Buyer - store), (Buyer - Product) and (Product - store)

2) Further if any record is removed from Model TR it will result in loss of valuable information. For ex:-

Bid	Pid	Sid	
B_1	P_1	S_1	→ (A)
B_2	P_2	S_1	
B_2	P_2	S_2	

If record (A) is removed, we might loose the information that product P_1 was available in store S_1. Similarly information about (Buyer - store) and (Buyer - Product) pairs can also be lost.

3) Thus model TR fails to express such kind of requirements for our database.

On the other hand :-

(4) Model "BR" is successful in holding information about the individual pairs but it is not able to ~~tell~~ tell from where a given product is bought by a given Buyer.

For ex:- Suppose

=>

PB relationship

Bid	Pid
B_1	P_1
B_1	P_2

Ps Relationship

Pid	Sid
P_1	S_1
P_1	S_2
P_2	S_1
P_2	S_2

BS Relationship

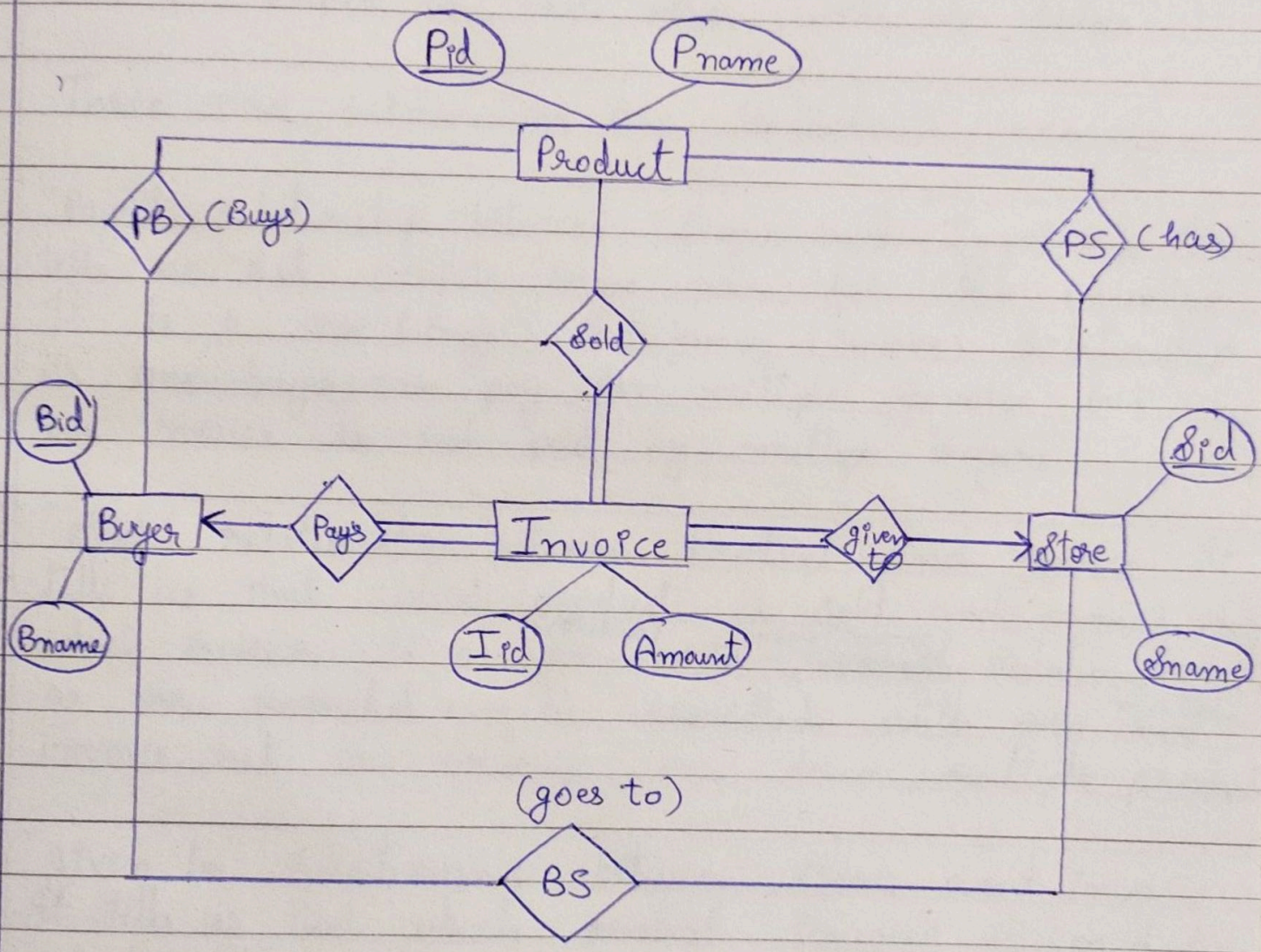
Bid	Sid
B_1	S_1
B_1	S_2

Now, since B_1 goes to both store 1 and store 2 and product P_1 and P_2 are available both in store 1 and store 2, there is no way we can tell that product P_1 was bought by buyer B_1 from store S_1 or S_2.

(5) Thus, Both of them have their limitations and advantages and none of them is able to fulfill all the requirements. Thus let us create a new ER model to express the requirements

The new ER model

1.) Given: Only binary relationship can be used.



:- This ER model will successfully fulfill all the requirements and will provide all the necessary information for our database.

:- A new entity set has been introduced namely; "Invoice" with 2 attributes :- Iid (primary key) and amount.

:- The basic reason for inclusion of a new entity is that since a ternary relationship can't be used, this new entity will act as a common ground and the other 3 entities can be linked to each other with its helps

:- Three new relationships are introduced, namely

1.) "Pays" relationship between Buyer and Invoice. It tells us that which buyer pair for which invoice. It is a one (Buyer) -to- many (invoice) relationship as one buyer can pay for multiple invoice but one invoice is not paid by multiple buyers

2.) "Sold" relationship between Product and invoice. It tells us that which product is sold and present in which invoice. It a many (Product) -to- many (invoice) relationship as one productid can be associated with ~~only~~ multiple invoice but one invoice can have multiple product

3.) "given to" relationship between store and invoice. It tells us that which ~~product~~ invoice is paid to which store. It is many (invoice) -to- one (store) relationship. as on store have many invoices but one invoice is associated with one store only.

The other 3 relationships between (Product-Buyer) (Buyer-store) and (Store-products) remains the same.

Also, In all 3 relationship i.e "pays", "sold" and "goes to", invoice is in total relationship with buyer, product and store respectively.

This ensures that an invoice is generated only when a product is bought from a store and is paid by a buyer. Otherwise generation of any invoice in absence of any of the entity is absurd and this it provides extra safety to our database.

Key points

1) Our new ER model has all the relationships that were present in previous (PBS model using binary relation), thus we can get all the information regarding (Buyer - product), (product - store) and (store - Buyer) pairs.

2) Let us look at one of the examples :-

Pays Relationship		sold relationship		given to relation.	
Bid	Iid	Pid	Iid	Sid	Iid
B_1	I_1	P_1	I_1	S_1	I_1
B_2	I_2	P_1	I_2	S_2	I_2
		P_2	I_1		
		P_2	I_2		

We can simply do a natural join on this

tables to get the following

Bid	Pid	Sid	Iid
B_1	P_1	S_1	I_1
B_1	P_2	S_1	I_1
B_2	P_1	S_2	I_2
B_2	P_2	S_2	I_2

Hence we can also fulfill the requirements of our previous ternary model of PBS.

3) Even if any record in above table gets deleted there is no loss of information. since other relationship will still hold these info.

Also total participation of invoice ensures that no absurb relationship exists. For ex:- If there is no product in invoice there is no sense of generating invoice hence error can be identified.

Overall, the new ER model made of only binary relationship can completely satisfy all the Requirements.