Question 1 (2 marks each)

Consider the following relational schema for the next fifteen questions:

Product(product_id, product_name, description, category_id, supplier_id, price, units_in_stock,
PRIMARY KEY (product_id),
FOREIGN KEY (category_id) REFERENCES Category(category_id),
FOREIGN KEY (supplier_id) REFERENCES Supplier(supplier_id))

Category(category_id, category_names
PRIMARY KEY (category_id))

Supplier(supplier_id, supplier_name, contact_name, email, phone
PRIMARY KEY (supplier_id))

Customer(customer_id, first_name, last_name, email, phone
PRIMARY KEY (customer_id))

Order(order_id, customer_id, order_date,
PRIMARY KEY (order_id),
FOREIGN KEY (customer_id) REFERENCES Customer(customer_id))

Order_Item(order_item_id, order_id, product_id, quantity,
PRIMARY KEY (order_item_id),
FOREIGN KEY (order_id) REFERENCES Order(order_id),
FOREIGN KEY (product_id) REFERENCES Product(product_id))

TABLES

Product Table

Product_id	product_name	description	category_id	supplier_id	price	units_in_stock
1	MacBook Pro	Powerful laptop for professionals	1	1	2199.00	100
2	iPhone 13	smartphone with A15 Bionic chip	2	1	799.00	50
3	Samsung QLED	High-end QLED TV	3	2	1799.00	75
4	Nest Thermostat	Smart thermostat	4	3	249.00	200
5	Bose QC35 II	Wireless headphones	5	4	299.00	150

Category Table:

category_id	category_name
1	Laptop
2	Phone
3	TV
4	Smart Thermostate
5	Headphone

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Customer Table:

customer_id	first_name	last_name	email	phone
1	John	Doe	johndoe@example.com	555-123-4567
2	Jane	Smith	janesmith@example.com	555-234-5678
3	Bob	Johnson	bobjohnson@example.com	555-345-6789
4	Sarah	Lee	sarahlee@example.com	555-456-7890
5	David	Kim	davidkim@example.com	555-567-8901

Supplier Table:

supplier_id	supplier_name	contact_name	email	phone
1	Apple Inc.	Tim Cook	tcook@apple.com	555-111-1111
2	Samsung	Kim Hyun Suk	khs@samsung.com	555-222-2222
3	Google Nest	Rishi Chandra	rchandra@nest.com	555-333-3333
4	Bose Corporation	Phil Hess	phess@bose.com	555-444-4444
5	Sony Corporation	Kenichiro Yoshida	kyoshida@sony.com	555-555-5555

Order Table:

order_id	customer_id	order_date
1	2	2022-01-05
2	5	2022-02-10
3	4	2022-03-15
4	3	2022-04-20
5	1	2022-05-25
6	2	2022-06-30
7	3	2022-07-05
8	4	2022-08-10
9	1	2022-09-15
10	5	2022-10-20

Order_Item Table:

order_item_id	order_id	product_id	quantity
1	1	1	2
2	1	2	1
3	2	3	1
4	2	4	2
5	3	5	1
6	3	2	2
7	4	1	1
8	4	4	1
9	5	2	1
10	5	5	1
11	6	4	1
12	6	3	1
13	7	2	1
14	7	5	2
15	8	1	1

1. SELECT product_name, price FROM product WHERE price > (SELECT AVG(price) FROM product);
   Which of the following statements is true about the output of this query?

A. It will return a list of all products and their prices.
B. It will return a list of all products with a price greater than the average price of all products.
C. It will return a list of all products with a price less than the average price of all products.
D. It will return an error, as there is no AVG function in SQL.

2. Which of the following SQL queries will return the number of products in the Product table with a price greater than $50?
   A. SELECT COUNT(*) FROM Product WHERE price > 50;
   B. SELECT * FROM Product WHERE price > 50;
   C. SELECT MIN(price) FROM Product WHERE price > 50;
   D. SELECT product_name FROM Product WHERE price > 50;

3. Which of the following SQL commands will update the product price to $10.99 for all products in the Product table?
   A. UPDATE Product SET price = '10.99' WHERE product_id > 1;
   B. UPDATE Product SET price = 10.99 WHERE product_id > 1;
   C. UPDATE Product SET price = '10.99';
   D. UPDATE Product SET price = 10.99;

4. Which of the following SQL commands will update the customer phone number to '123-456-7890' for the customer with customer_id = 3 in the Customer table?
   A. UPDATE Customers SET phone = '123-456-7890' WHERE customer_id = 3;
   B. UPDATE Customers SET phone = '123-456-7890' WHERE phone = 'customer_id = 3';
   C. UPDATE Customers SET phone = 123-456-7890 WHERE customer_id = 3;
   D. UPDATE Customers SET phone = '123-456-7890' WHERE customer_id < 4;

5. Which of the following SQL queries will return the name of the supplier with the highest number of products in the Product table?
   A. SELECT supplier_name FROM Suppliers ORDER BY COUNT(*) DESC LIMIT 1;
   B. SELECT supplier_name FROM Suppliers WHERE supplier_id = MAX(SELECT COUNT(*) FROM Products);
   C. SELECT supplier_name FROM Suppliers WHERE supplier_id = MAX(SELECT supplier_id, COUNT(*) FROM Products GROUP BY supplier_id);
   D. SELECT supplier_name FROM Suppliers WHERE supplier_id = MAX(SELECT COUNT(DISTINCT product_name) FROM Products);

6. Which of the following SQL queries will return the product name, supplier name, and category name for all products in the Product table?
   A. SELECT product_name, supplier_name, category_name FROM Products;
   B. SELECT product_name, supplier_name, category_name FROM Products JOIN Suppliers ON Products.supplier_id = Suppliers.supplier_id JOIN Categories ON Products.category_id = Categories.category_id;
   C. SELECT product_name, supplier_name, category_name FROM Products JOIN Suppliers ON Products.supplier_id = Suppliers.supplier_id WHERE Products.category_id = Categories.category_id;
   D. SELECT product_name, supplier_name, category_name FROM Products natural JOIN Categories ON Products.category_id = Categories.category_id natural JOIN Suppliers ON Products.supplier_id = Suppliers.supplier_id;

7. Which of the following SQL queries will return the customer name and order date for all orders placed by customers in the Customer table? Select the most suitable option.
   A. SELECT customer_name, order_date FROM Orders natural JOIN Customers ON Orders.customer_id = Customers.customer_id;
   B. SELECT customer_name, order_date FROM Customers JOIN Orders ON Customers.customer_id = Orders.customer_id;

C. SELECT customer_name, order_date FROM Orders JOIN Customers ON Customers.customer_id = Orders.customer_id JOIN Order_Items ON Orders.order_id = Order_Items.order_id;
D. SELECT customer_name, order_date FROM Customers JOIN Order_Items ON Customers.customer_id = Order_Items.customer_id;

8. Which of the following SQL queries will return the product name and total quantity ordered for each product in the Product table?
   A. A. SELECT product_name, COUNT(*) as total_quantity FROM Product JOIN Order_Item ON Product.product_id = Order_Item.product_id GROUP BY Product.product_name
   B. B. SELECT product_name, COUNT(quantity) as total_quantity FROM Product JOIN Order_Item ON Product.product_id = Order_Item.product_id GROUP BY Product.product_name
   C. C. SELECT product_name, AVG(quantity) as total_quantity FROM Product JOIN Order_Item ON Product.product_id = Order_Item.product_id GROUP BY Product.product_name
   D. D. SELECT product_name, SUM(quantity) as total_quantity FROM Product JOIN Order_Item ON Product.product_id = Order_Item.product_id GROUP BY Product.product_name

9. Which SQL query can be used to find the average price of products sold by supplier "Samsung"?
   A. SELECT AVG(products.price) FROM products JOIN suppliers ON products.supplier_id = suppliers.supplier_id WHERE suppliers.supplier_name = "Samsung";
   B. SELECT AVG(products.price) FROM products INNER JOIN suppliers ON products.supplier_id = suppliers.supplier_id WHERE suppliers.supplier_name = "Samsung";
   C. SELECT AVG(price) FROM products WHERE supplier_id = (SELECT supplier_id FROM suppliers WHERE supplier_name = "Samsung");
   D. SELECT AVG(price) FROM products WHERE supplier_name = "Samsung";

10. Which SQL query can be used to retrieve the total number of products in each category?
   A. SELECT COUNT(*) FROM products GROUP BY category_id;
   B. SELECT category_name, COUNT(*) FROM products INNER JOIN categories ON products.category_id = categories.category_id;
   C. SELECT category_name, COUNT(*) FROM products INNER JOIN categories ON products.category_id = categories.category_id GROUP BY category_name;
   D. SELECT category_name, SUM(*) FROM products INNER JOIN categories ON products.category_id = categories.category_id GROUP BY category_name;

11. Which SQL query can be used to retrieve the category name of the product with the highest price?
   A. SELECT category_name FROM products INNER JOIN categories ON products.category_id = categories.category_id WHERE price = MAX(price);
   B. SELECT category_name FROM products INNER JOIN categories ON products.category_id = categories.category_id WHERE price = (SELECT MAX(price) FROM products);
   C. SELECT category_name FROM products INNER JOIN categories ON products.category_id = categories.category_id WHERE price = (SELECT MAX(price) FROM products ORDER BY price);
   D. SELECT category_name FROM products INNER JOIN categories ON products.category_id = categories.category_id WHERE price IN (SELECT MAX(price) FROM products);

12. Which of the following is calculating the total revenue generated by any particular supplier?
   A. SELECT SUM(price * units_in_stock) FROM Product WHERE supplier_id = supplier_id_value;
   B. SELECT SUM(total_amount) FROM Order JOIN Order_Item ON Order.order_id = Order_Item.order_id JOIN Product ON Product.product_id = Order_Item.product_id WHERE Product.supplier_id = supplier_id_value;

C. SELECT SUM(price * quantity) FROM Product JOIN Order_Item ON Product.product_id = Order_Item.product_id JOIN Order ON Order.order_id = Order_Item.order_id WHERE Product.supplier_id = supplier_id_value;

D. SELECT SUM(total_amount) FROM Order JOIN Customer ON Order.customer_id = Customer.customer_id JOIN Product ON Product.product_id = Order_Item.product_id WHERE Product.supplier_id = supplier_id_value;

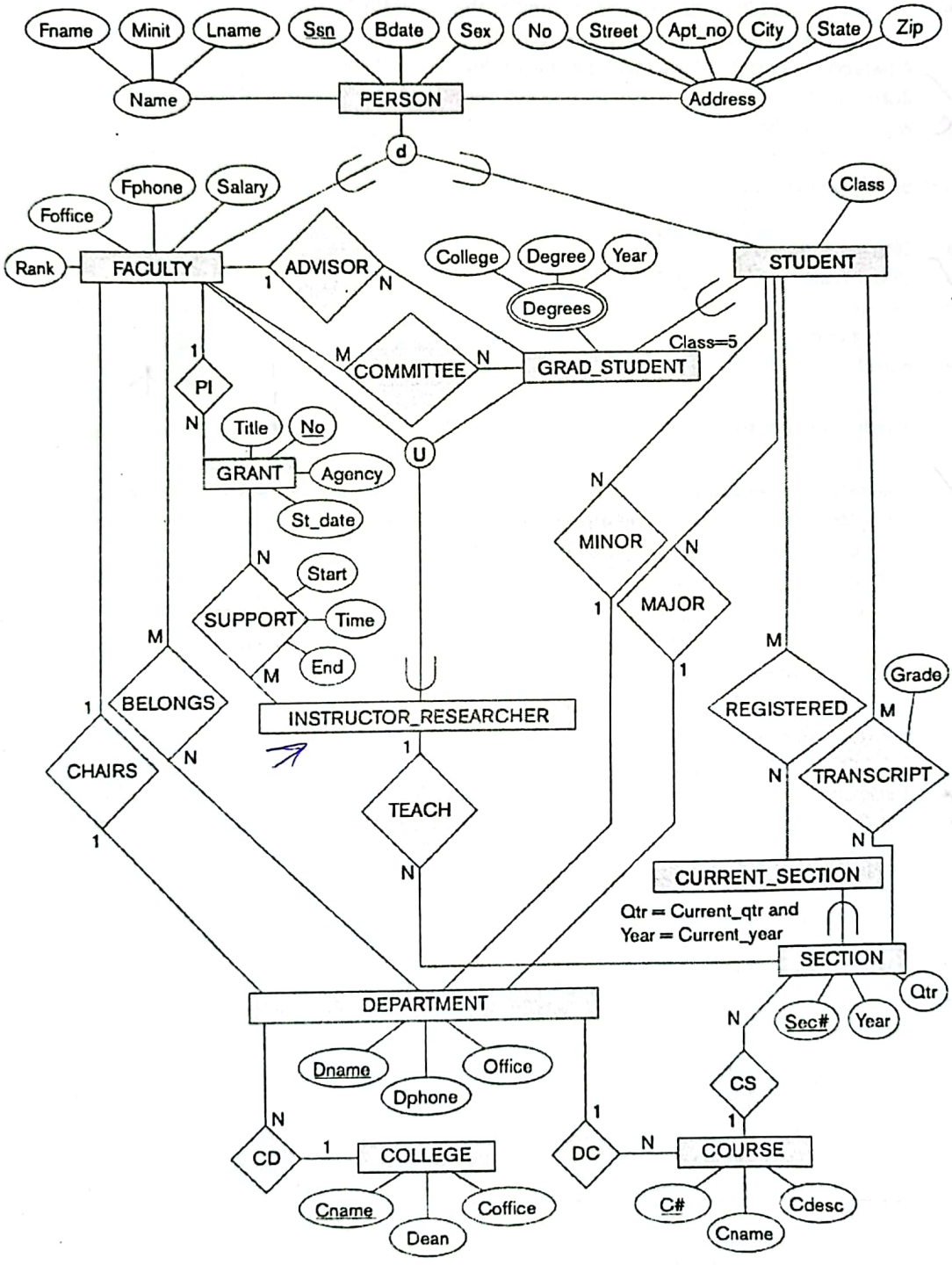
13. Which of the following SQL queries will return the total revenue generated by orders placed by customers in January 2022?
    A. SELECT SUM(unit_price * quantity) FROM Customer JOIN Order ON customer.customer_id = Order.customer_id JOIN Order ON Order.order_id = Order_Item.order_id WHERE order_date BETWEEN '2022-01-01' AND '2022-01-31';
    B. SELECT SUM(quantity) FROM Product JOIN Order_Item ON Product.product_id = Order_Item.product_id JOIN Order ON Order.order_id = Order_Item.order_id WHERE order_date BETWEEN '2022-01-01' AND '2022-01-31';
    C. SELECT COUNT(unit_price * quantity) FROM Product JOIN Order_Item ON Product.product_id = Order_Item.product_id JOIN Order ON Order.order_id = Order_Item.order_id WHERE order_date BETWEEN '2022-01-01' AND '2022-01-31';
    D. SELECT SUM(unit_price * quantity) FROM Product JOIN Order_Item ON Product.product_id = Order_Item.product_id JOIN Order ON Order.order_id = Order_Item.order_id WHERE order_date BETWEEN '2022-01-01' AND '2022-01-31';

Consider the following query for the next two questions (Q14 & Q15):
SELECT customers.customer_name FROM customers JOIN orders ON customers.customer_id = orders.customer_id JOIN order_items ON orders.order_id = order_items.order_id WHERE order_items.item_price = (SELECT MAX(item_price) FROM order_items)

14. Which of the following best describes the purpose of the query?
    A. To calculate the total amount of sales for each customer
    B. To identify the customer who purchased the most expensive product
    C. To calculate the average price of each product
    D. To identify the supplier who provided the most products

15. How would the results of the query change if the subquery in the WHERE clause was replaced with SELECT MIN(item_price) FROM order_items?
    A. The query would return the customer who purchased the cheapest product
    B. The query would return an error because the subquery returns more than one row
    C. The query would return the customer who purchased the least expensive product with the same price as the most expensive product
    D. The query would return the customer who purchased the most expensive product with the same price as the least expensive product

Question 2 (1 mark each)



Consider a UNIVERSITY database which keeps track of students and their majors, transcripts, and registration as well as of the university's course offerings. The database also keeps track of the sponsored research projects of faculty and graduate students. This schema is shown in figure above.

16. Which of the following is correct:
    a. A person can be both faculty and student at the same time
    b. A person can either be a faculty or a student
    c. A person may neither be a faculty nor a student at any time
    d. Both b and c
    e. None of the above

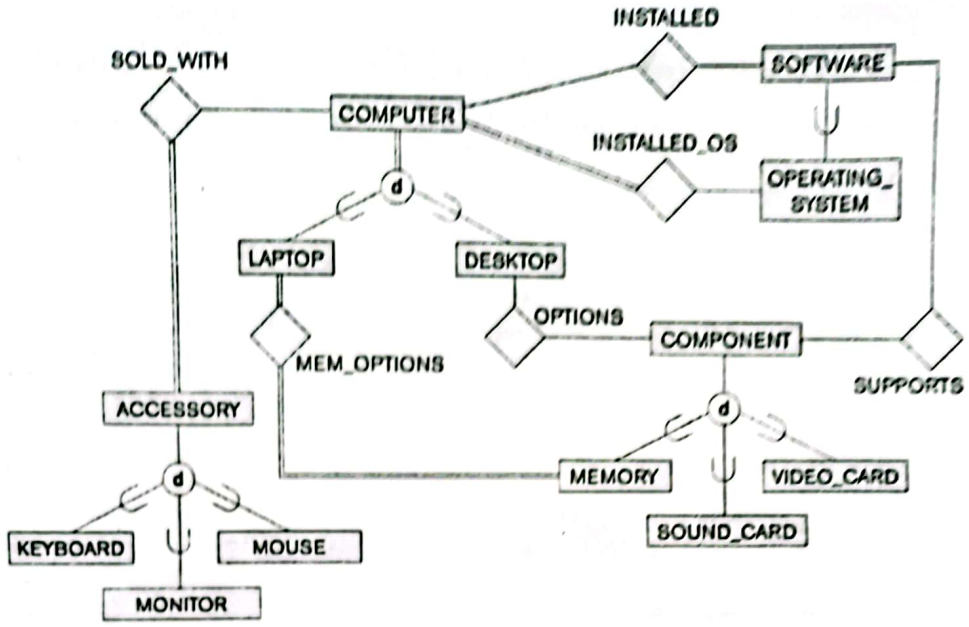
17. The Instructor_Researcher is a:
    a. Disjoint Subclass
    b. Union type
    c. Category
    d. Both a and c
    e. Both b and c

18. Which of the following is true:
    a. The Instructor_Researcher can be both Faculty and Grad_Student at the same time
    b. The Instructor_Researcher can either be a Faculty or Grad_Student at any time
    c. Instructor_Researcher is the sub-class in the hierarchy
    d. Both a and b
    e. Both b and c

19. Which of the following is NOT true:
    a. Section is the subclass of Current_Section
    b. Current_Section is the subclass of Section
    c. A current_section must have the attributes Sec#, Qtr, Year
    d. The Current_Section must always have the Qtr value as Current_Qtr
    e. None of the above

20. Which of the following are defining predicates (attributes):
    a. Class
    b. Qtr
    c. Year
    d. Only a and b
    e. a, b and c

Consider the figure below for next 3 questions



d, o, u

21. Which of the following is incorrect:
    a. Operating system is a specialized software
    b. A desktop is a specialized computer
    c. Software is a specialized Operating system
    d. Both a and c
    e. Both b and c
22. Which of the following is correct:
    a. An accessory will always be either a mouse, a keyboard or a monitor
    b. An accessory can either be a mouse or a keyboard or a monitor and nothing else
    c. An accessory can be both a mouse and keyboard at the same time
    d. A monitor is an accessory
    e. None of the above
23. Which of the following is incorrect:
    a. A computer will always be either a laptop or a desktop
    b. A computer can either be a laptop or a desktop and nothing else
    c. A computer can neither be a laptop or desktop
    d. A desktop is a computer
    e. None of the above
24. Which one of the following is a set of one or more attributes taken collectively to uniquely identify a record?
    a) Candidate key
    b) Sub key
    c) Super key
    d) Foreign key
25. The subset of a super key is a candidate key under what condition?
    a) No proper subset is a super key
    b) All subsets are super keys
    c) Subset is a super key
    d) Each subset is a super key
26. A _____ integrity constraint requires that the values appearing in specified attributes of any tuple in the referencing relation also appear in specified attributes of at least one tuple in the referenced relation.
    a) Referential
    b) Referencing

c) Specific

d) Primary

27. From the below table we can conclude some valid functional dependencies:

roll_no	name	dept_name	dept_building
42	abc	CO	A4
43	pqr	IT	A3
44	xyz	CO	A4
45	xyz	IT	A3
46	mno	EC	B2
47	jkl	ME	B2

a) dept_name → dept_building , Dept_name

b) dept_building → dept_name

c) roll_no → { name, dept_name, dept_building }

d) None of the above

28. Below is an instance of R(A1,A2,A3,A4). Choose the FD which may hold on R

A1	A2	A3	A4
1	2	3	4
1	2	3	5
6	7	8	2
2	1	3	4

a) A4 →A1

b) A2 A3→A4

c) A2 A3→A1

d) None of the above

29. Given that X, Y, and Z are sets of attributes in a relation R, with functional dependency X->Y, Y->Z, one can derive several properties of functional dependencies. Identify correct dependencies

(i) X->YZ (ii) XZ->YZ (iii) Y->X

x → y
y → z

a) Only (i)

b) (i) and (iii)

c) Only (ii)

d) (i) and (ii)

30. Which functional dependency is invalid as per the table below?

xz → yz

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A	B	C	D	E
a1	b1	c1	d1	e1
a2	b1	C2	d2	e1
a3	b2	C1	d1	e1
a4	b2	C2	d2	e1
a5	b3	C3	d1	e1

A - A {B, C, D, E}

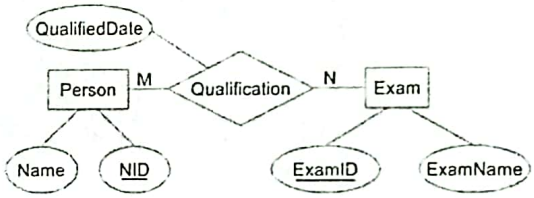
B {C, D, E}

B → ADE

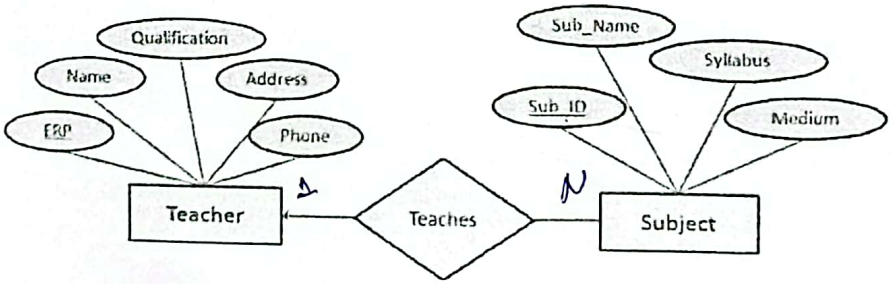
C → ADE

a) BC → ADE
b) C → D
c) B → E
d) AB → E
e) None of the above

31. Consider the following Entity Relationship Diagram (ERD)below. Which of the following possible relations will not hold if the above ERD is mapped into a relation model ?



a) Person (NID, Name)
b) Qualification (NID, ExamID, QualifiedDate)
c) Exam (ExamID, NID, ExamName)
d) Exam (ExamID, ExamName)
e) ExamName)



1 : N

32. What are the relation schemas that we get when we reduce the ERD in Figure above. Teacher can teach multiple courses?

a) Teacher(ERP, Name, Qualification, Address, Phone); Subject(Sub_ID, Sub_Name,
Teaches(ERP, Sub_ID)

tion, Address, Ph

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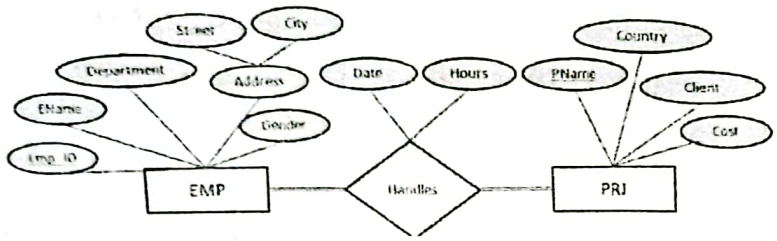


33. Which is the correct relational mapping?

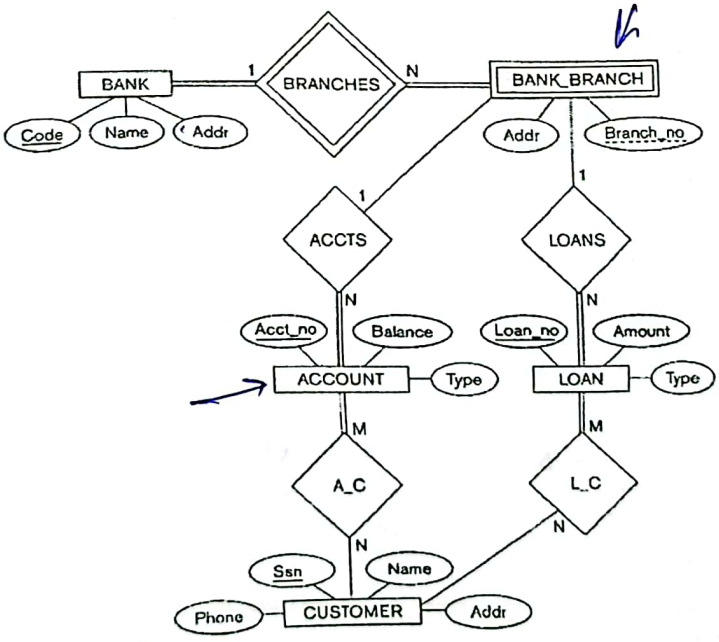
a) EMP(Emp_ID, EName, Department, Address, Street, City, Gender); PRJ(PName, Country, Client, Cost); Handles(Emp_ID, PName, Date, Hours)

b) EMP(Emp_ID, EName, Department, Address, Gender); PRJ(PName, Country, Client, Cost); Handles(Emp_ID, PName)

c) EMP(Emp_ID, EName, Department, Street, City, Gender); PRJ(PName, Country, Client, Cost, Emp_ID); Handles(Date, Hours)

d) EMP(Emp_ID, EName, Department, Street, City, Gender); PRJ(PName, Country, Client, Cost); Handles(Emp_ID, PName, Date, Hours)

Consider the following figure for the next two questions



...NT table in relational database design as per the figure?