Consider the following relational schema, which will be referred to as WORKING SCHEMA, which maintains information about a pizza restaurant:

ORDER(**ocode**: d1, **address**: d4, **date**: d5)
PK:{ocode }

ORDER_ITEM(**ocode**: d1, **pcode**: d2, **size**: d6)
PK:{ocode, pcode}
NNV:{size}
FK:{ocode} -> Order On delete cascade
On update cascade
FK:{pcode} -> Pizza On delete cascade
On update cascade

SPECIAL_ITEM(**ocode**: d1, **pcode**: d2, **icode**: d3, **comment**: d7)
PK:{ocode, pcode, icode}
NNV:{comment}
FK:{ocode,pcode} -> Order_item On delete cascade
On update cascade
Weak referential integrity

FK:{pcode,icode} -> Recipe On delete cascade
On update cascade
Partial referential integrity

PIZZA(**pcode**: d2, **name**: d8)
PK:{pcode }
NNV:{name}

RECIPE(**pcode**: d2, **icode**: d3, **weight**: d9)
PK:{pcode, icode}
FK:{pcode} -> Pizza On delete cascade
On update cascade
FK:{icode } -> Ingredient

INGREDIENT(**icode**: d3, **name**: d10, **stock**: d11)
PK:{icode }
NNV:{stock}

ORDER: The order with code *ocode* must be delivered to the *address* the day *date*.

ORDER_ITEM: The order *ocode* includes the pizza *pcode* with size *size*.

SPECIAL_ITEM: The ingredient *icode*, used in the pizza *pcod* for the order *ocode*, must follow the special requirements appearing in the *comment*.

PIZZA: The pizza with code *pcode* is called *name*.

RECIPE: The recipe of the pizza *pcode* contains the ingredient *icode* with a total weight of *weigth* units.

INGREDIENTS: The basic ingredient *icode* is called *name* and there are *stock* units in the restaurant.

Consider the following extension of the previous schema. We will refer to this extension as database (DB). **Empty cells represent null values**

ORDER		
ocode	**address**	**date**
01	Mar, 12	1/1/17
02	Rio Grande, 33	
03		2/1/17

ORDER_ITEM		
ocode	**pcode**	**size**
01	P1	G
01	P8	M
02	P2	G

PIZZA	
pcode	**name**
P1	Ham
P2	BBQ
P8	Vegetarian

RECIPE		
pcode	**icode**	**weight**
P1	I1	
P1	I2	3
P2	I1	
P2	I3	2
P8	I4	4

INGREDIENT		
icode	**name**	**stock**
I1	Cheese	1000
I2		5
I3	Beef	4
I4		10

SPECIAL_ITEM			
ocode	**pcode**	**icode**	**Comment**
02	P2	I3	undercooked

Lastname:_____ Name: _____

Circle the correct answer for each question.

This test penalizes students' incorrect answers with negative points (1/3) to discourage guessing.

1. Consider the foreign key in the relation Order_item FK:{ocode} -> Order. The only operations that may violate the referential integrity are:
   a) Delete a tuple or update any attributte in the primary key of Order_item, Insert a tuple or update the foreign key in Order
   b) Delete a tuple or update ocode in Order_item, Insert a tuple or update the foreign key in Order.
   c) It depends on the referential integrity type (weak, partial, or full).
   d) Insert a tuple or update the ocode in the Order_item relation, and delete a tuple or update the ocode in the Order relation.

2. Let R, S, and T be relations. Considering the cardinalities (card) of these relations, What are the maximum and minimum cardinalities of the expression R ⊗ (S - T) ?
   a) The minimun cardinality is 0, and the maximum is card(R) x (card(S) - card(T))
   b) The minimun cardinality is card(R), and the maximum is card(R) x (card(S) - card(T)).
   c) The minimun cardinality is 0, and the maximum card(R) x card(S).
   d) The minimun cardinality is card(R) x (card(S) - card(T)), and the maximum is card(R) x card(S).

3. How can we include the following constraint: "The date of an order cannot be decreased"?
   a) By adding a transition integrity constraint, that could be implemented using a trigger.
   b) By adding a table constraint into the Order table, which could be implemented using a "Check" constraint.
   c) By adding an attribute constraint into the Order table.
   d) It is no possible to represent this kind of constraint in the relational data model.

4. Which statement referring to the working schema is TRUE?
   a) There cannot be two Pizzas with the same name.
   b) All pizzas have at least one ingredient in its Recipe.
   c) It is no possible to use one ingredient with no stock (or stock =0) in any recipe.
   d) All the recipes use at least one ingredient.

5. What query is represented by the following expression ?

$$(\text{Pizza}[\text{pcode, name}] \otimes_{\text{pcode}} ((\text{Recipe WHERE weight} > 20)[\text{code}]))\ [\text{name}]$$

6. Complete the content of the tables after the execution of the following sentence

```
DELETE FROM Pizza WHERE pcode='P2'
```

Answers:

1.- d
2.- c
3.- a
4.- d
5.- Names of the pizzas with at least one ingredient with a weight greater than 20
6-

ORDER		
ocode	**address**	**date**
01	Mar, 12	1/1/17
02	Rio Grande, 33	
03		2/1/17

ORDER_ITEM		
ocode	**pcode**	**size**
01	P1	G
01	P8	M
~~02~~	~~P2~~	~~G~~

PIZZA	
pcode	**name**
P1	Ham
~~P2~~	~~BBQ~~
P8	Vegetarian

RECIPE		
pcode	**icode**	**weight**
P1	I1	
P1	I2	3
~~P2~~	~~I1~~	
~~P2~~	~~I3~~	~~2~~
P8	I4	4

INGREDIENT		
icode	**name**	**stock**
I1	Cheese	1000
I2		5
I3	Beef	4
I4		10

SPECIAL_ITEM			
ocode	**pcode**	**icode**	**Comment**
~~02~~	~~P2~~	~~I3~~	~~undercooked~~