

**CMPS 277****Time: 2 Hrs.****Final Examination****Fall 2003-2004**

<b>Family Name</b>	
<b>First Name</b>	
<b>Id. Number</b>	
<b>Section</b>	<b>3 (9:30 TR)</b> <b>4 (12:30 TR)</b>

Write down your answers on the question sheet. You can use the last page as well as the reverse side of each page for scratch work. There are pages all together (the last page is blank) **DO NOT CUT OFF ANY PAGE.**

Good Luck.

Problem	Grade	Out Of
1		15
2		15
3		30
4		30
5		15
6		20
7		10
8		15
<b>Total</b>		<b>150</b>



**Problem 2 (15 Points)**

Consider the relational schema  $R = (A, B, C, D, E)$ , and assume that the following set  $F$  of functional dependencies hold on  $R$ :

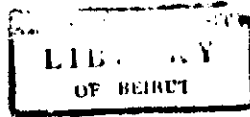
$$F = \{ A \rightarrow BC, CD \rightarrow E, B \rightarrow D, E \rightarrow A \}$$

- a. Suppose that the schema  $R$  is decomposed into  $R_1 = (A, B, C)$  and  $R_2 = (A, D, E)$ . Show that the decomposition is lossless-join..

- b. Show that the decomposition in (a) above is not dependency-preserving.

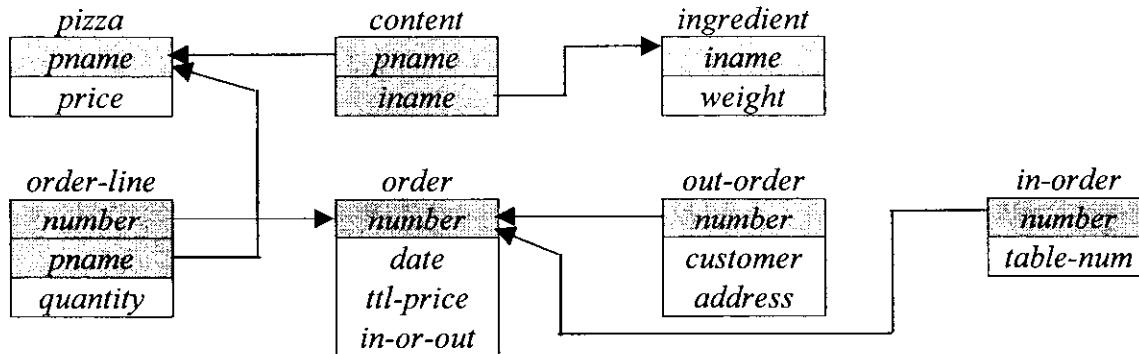
- c. Compute  $B^+$

- d. Is  $CD$  is a candidate key for  $R$ . Why?



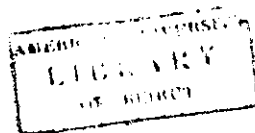
**Problem 3. ( 30 Points)**

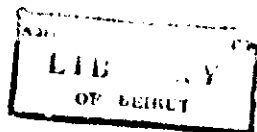
Zakariya has designed the following relational database schema for his "Zakkour's Pizza House".



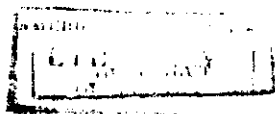
The database is supposed to keep track of the different kinds of pizza that are available at Zakkour's Pizza House. This is kept in the relation *pizza*, which is identified by *pname* (the name of the pizza like Plain, Hawaiian, Margaritta, Vegetarian, Cecilian, etc...), and contains the *price* attribute. The ingredients that are used in the pizza's are stored in the relation *ingredient*. This relation is identified by the name of the ingredient, *iname*, (like cheese, tomato sauce, mushrooms, pepperoni, onions, olives, anchovies, etc...) and stores the *weight* of each ingredient portion. The ingredient contents of every pizza type is stored in the relation *content*, which is identified by the pair of attributes (*pname*, *iname*). The database also maintains the orders placed by customers. Orders are of two types: Orders at the pizza house (In-Orders), and orders to delivered to an address (Out-Orders). With every order is kept the order number, *number*, which is a serial number that identifies an order, the *date* of the order, the total price (*tll-price*), and its type *in-or-out*. In addition, for In-Orders the database stores the table number for that order, and for Out-Orders the name of the customer, and the delivery address are maintained. Moreover, an order consists of one or more *order-lines*, which indicates a pizza kind that is being ordered and the *quajntity* of that kind of pizza being ordered, e.g. a tuple (1234, 'Hawaiian', 3) in *order-line* means that in order 1234, the customer needs 3 Hawaiian pizzas.

- a. Give an appropriate ER diagram for this database, indicating all appropriate constraints.





- b. Suppose that it is a “business rule” that every kind of pizza must contain a portion of cheese and a portion of tomato sauce. Can this business rule be expressed in the ER diagram you have given? Why?
- c. Zakariya decides to add a new variant to the pizza products he sells: to allow the pizza of any kind to be either thin or thick, and at the same price. Suggest minimal changes to the given relational database design to enable the storage of such orders. Give a brief explanation.
- d. Indicate how the changes in (c) would affect your ER diagram of (a).



**Problem 4 (30 Points)**

Referring to the relational design given above for "Zakkour's Pizza House" database, write the following in SQL:

a. Give a definition for the tables (relations) *order* and *order\_line*. (Include constraint)

b. Build an index *number\_indx* on *order* whose search key is *number*

c. Add to the database a new kind of pizza *Thuraya* (Zakariya's wife name!!) priced at 22000, and which contains the ingredients: Cheese, Tomato Sauce, and Shrimps.

What should the system do if while executing the statements in your answer to (c), the ingredient Shrimps is not in the database ? Why ?





- g. Find the pizza that has in it all the ingredients.  
First give this query in relational algebra.

Now give the query in SQL.

- h. Enforce the business rule (integrity constraint!) that every kind of pizza must contain cheese and tomato sauce.

