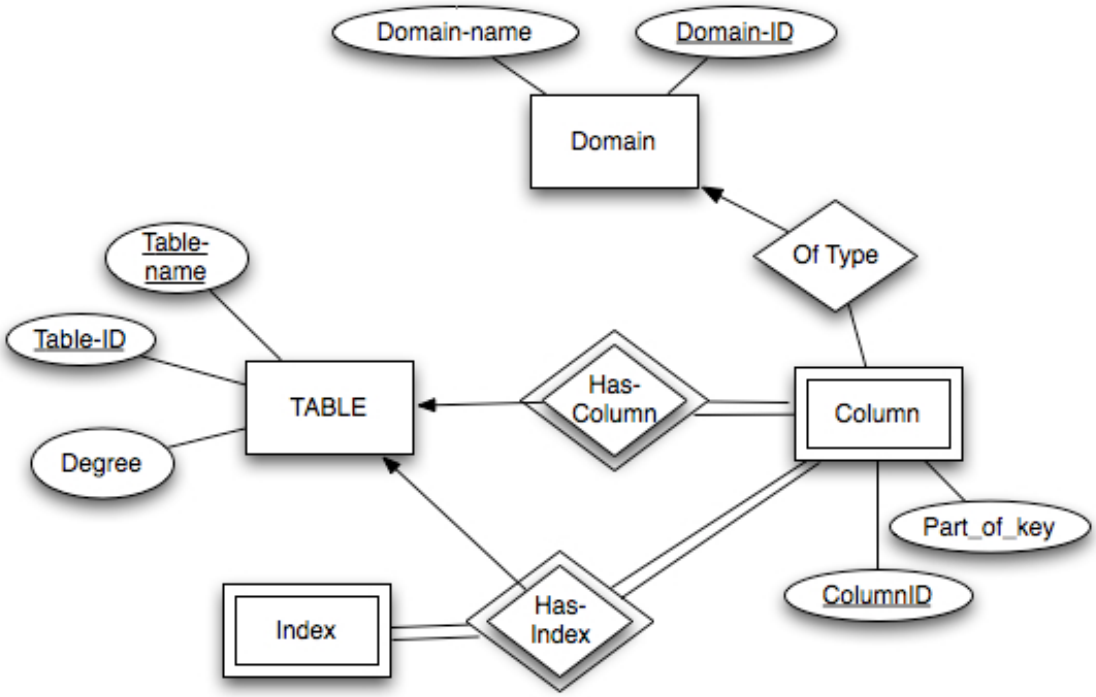
CMSC 424, Spring 2012: Homework 2 (Due March 8, 2012)

1. E-R Conceptual Modeling

(a) Construct an E-R diagram for an online bookstore with multiple warehouses selling books. The usual semantics for authors who have authored the books, customers buying the books, and shopping carts holding the orders of the customers. Note that a cart may have several books but is associated with a single customer. Include only the necessary attributes to support purchase transactions (price of a book and number of copies purchased, and warehouse(s) to be delivered from) and the appropriate keys for the entities and relationships. Illustrate the keys.

(b) Map your E-R model to a relational schema and identify the keys (primary and foreign).

(c) Describe in English what this E-R diagram models.



2. Functional Dependencies

Consider the following relation and the functional dependencies on it:

R(A,B,C,D,E,) : A → BC CD → E B → D E → A

a) Find all candidate keys. Then argue why there cannot be a candidate key with three attributes.
b) Is R in BCNF? Explain.
c) Is R in 3NF?
d) Is the decomposition R1(A,B,C) and R2(A,D,E) of R lossless or lossy? Justify your answer.
Is this decomposition FD preserving? If you answer is NO, what is not preserved?

Is the decomposition R3(A,B,C,D) and R4(C,D,E) of R lossless or lossy? Justify your answer.
Is this decomposition FD preserving? If you answer is NO, what is not preserved?

e) What is R1? Circle your answer BCNF 3NF NONE OF THESE
What is R2? Circle your answer BCNF 3NF NONE OF THESE
What is R3? Circle your answer BCNF 3NF NONE OF THESE
What is R4? Circle your answer BCNF 3NF NONE OF THESE
f) Using the decomposition algorithm lossless-ly decompose R into BCNF relations. Then check if it is FD preserving.