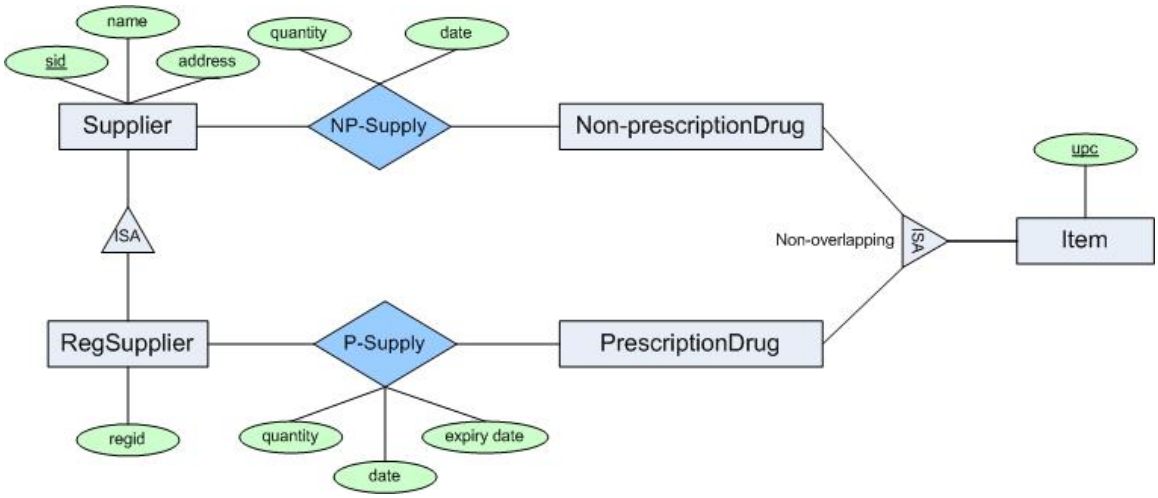
CPSC 304 Midterm 1
Oct 7, 2008
Total: 15 points
Time allowed: 80 minutes

Question 1 (6 points)
This question extends the drug store application studied in the project. Recall that there are two general categories of items: **prescription drug** items and **non-prescription** items. Each item is identified by a unique universal product code (UPC). (Other attributes of the items are irrelevant to this question.) In this question, we consider the suppliers that supply the items to the drug store. Each supplier is identified by a unique supplier number, a name, and an address. A supplier may supply prescription drug or non-prescription items. Each supply instance has a quantity and a supplied-date associated with it. Finally, the complication here is that a supplier of prescription drug items must have registered with Health Canada. Each registered supplier has a registry id. And for prescription drug items, each supply instance must have an expiry-date associated with it. Draw an entity-relationship diagram to represent the information described above.



Question 2 (5 points) Consider the relation scheme *R(A, B, C, D, E)* which satisfies the following functional dependencies:

- (FD1) $A\ B \rightarrow C\ D$
- (FD2) $D \rightarrow E$
- (FD3) $C \rightarrow B$

a) Identify all the candidate keys of R.
b) Give a formal proof of your answer given above. In other words, for every candidate key you identified, show that it is indeed a candidate key. You are allowed to use the following rules in your proof: reflexivity, augmentation, transitivity, union and decomposition.

a) two candidate keys: {A, B} and {A, C}
b) 1. $C\ D \rightarrow C\ E$ (augmentation FD2)
2. $A\ B \rightarrow C\ E$ (transitivity FD1 and 1)

3. $A\ B \rightarrow C\ D\ E$ (union FD1 and 2)

Thus, A B is a superkey.

4. $A\ C \rightarrow A\ B$ (augmentation FD3)

5. $A\ C \rightarrow C\ E$ (transitivity 2 and 4)

6. $A\ B \rightarrow D$ (decomposition FD1)

7. $A\ C \rightarrow D$ (transitivity 4 and 6)

8. $A\ C \rightarrow A\ B\ C\ D\ E$ (union 4, 5, 6)

Thus, A C is a superkey.

A does not appear on the RHS of any FD. Thus, B alone cannot be a superkey. A on its own never appears on the LHS of any FD. Thus, A alone cannot be a superkey. Hence, A B is minimal. Similarly, C alone cannot be a superkey. Hence, A C is minimal.

Question 3 (4 points) Continue with relation R above.

a) Is R in 3NF? Explain your answers.
b) Explain why R is not in BCNF.
c) Decompose R so that the resultant set of relations is in BCNF.
d) Decompose R so that the resultant set of relations is in 3NF.

a) No, because FD2 is not part of any candidate key.
b) If R is not in 3NF, it cannot be in BCNF.
c) R1 (A, B, D) , R2 (D, E), R3(B, C).
d) R1(A,B,C,D), R2(D,E).

--- The End ---