

CS4604 Midterm Exam

October 23, 2002

Please enter the following information:

- **Name:**
- **ID:**

GOOD LUCK!

Do not write below this line

Problem	Max Score	Score
1	25	
2	10	
3	15	
4	20	
5	20	
6	10	

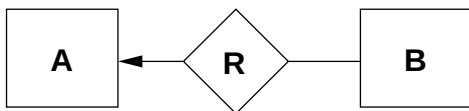
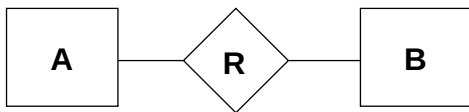
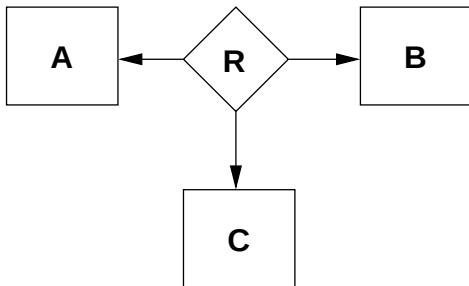
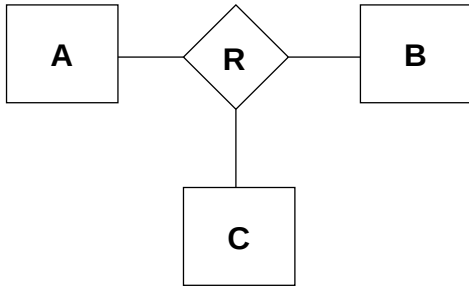
1. (25 points) Design an E/R diagram to model the following information about cars, rental agencies, and drivers. Drivers reserve cars from rental agencies. A car is uniquely distinguished by its VIN number, and has a model name and color. A rental agency is uniquely distinguished by its name, and has an address. A driver is uniquely distinguished by his/her SSN, and has a name, address, license registration number, and age. A driver can reserve any number of cars, and each of these cars could be reserved through different rental agencies. Any given car is rented through a unique rental agency (which presumably owns the car). Every reservation is for a unique car, handled by a unique rental agency, and can list upto 10 (designated) drivers. However, a reservation must have at least one driver. Try to model as much as you can, and write *Notes* if necessary. Failing to write *Notes* implies that your E/R diagram is *exact*.

2. (10 points) List all the non-trivial FDs and non-trivial MDs satisfied by the following relation. Including trivial FDs or trivial MDs would be cause for losing points.

A	B	C
a_1	b_1	c_1
a_1	b_1	c_2
a_2	b_1	c_1
a_2	b_1	c_3

3. (10+5=15 points) Suppose that the relation $R(A, B, C, D, E, G, H)$ with FDs $\{AB \rightarrow C, AC \rightarrow B, AD \rightarrow E, B \rightarrow D, BC \rightarrow A, E \rightarrow G\}$ is being broken into relation $S(A, B, C)$ and some other relations. What are the FDs that hold in S ? State also the strongest normal form that is not violated by S .

4. (20 points) For each of the following E/R diagrams, perform the push-out operation of converting a multiway relationship into a connecting entity set. Notice that the last two diagrams have only two-way relationships, but you should perform the push-out operation all the same. In all four cases, make sure the pushed-out diagram is consistent with the constraints in the original diagram.



5. (4*5 = 20 points) State True/False for each. No explanations needed.

- If a relation instance is violating an FD, then the relation can be made to satisfy the FD by possibly adding some selected tuples.
- If a relation instance is violating an FD, then the relation can be made to satisfy the FD by possibly removing some selected tuples.
- If a relation instance is violating an MD, then the relation can be made to satisfy the MD by possibly adding some selected tuples.
- If a relation instance is violating an MD, then the relation can be made to satisfy the MD by possibly removing some selected tuples.

6. (4+3+3=10 points) Consider the relation $R(A, B, C, D)$ with FDs $AB \rightarrow C, C \rightarrow A$, and $C \rightarrow D$. Assume that somebody has decomposed this relation into $\{A, C, D\}$ and $\{B, C\}$. Is this decomposition lossless? Does this decomposition preserve FDs? Does this decomposition reduce redundancy? Give reasons (for all three parts).