

Fall 2008: Mid-Term Exam

IEOR 115: Industrial and Commercial Data Systems

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Please put your full name and Student ID number on this page. Don't open the exam until instructed to do so.

You have 50 minutes to work. First check that your copy includes all 8 pages. Please read all questions first and budget your time accordingly (credit for each part is shown in parentheses). If you need to write on the back of a page, indicate the continuation with an arrow from the front of another page.

Name:

Student ID #:

Points: (Please do not write below this line)

Part 1 (10):

Part 2 (40):

Part 3 (40):

Part 4 (10):

1. (10) Logic

Does: $s \rightarrow \neg r \models s \vee r$? Prove or Disprove, showing all work.

2. (40) EER Diagrams

Joseph Wurzelbacher has purchased a plumbing company and needs a database. (note: you don't need to know anything about plumbing to answer this; if you have questions please ask me.)

- Joe wants to keep track of his customers. For each, he records their lastname, firstname, address, and one or more email addresses.
- Joe also records this info for all the plumbers that work for him. In addition, he assigns each plumber a unique PID. For those plumbers that are licensed, he records their PLN (plumbers license number). For those who are not licensed, Joe assigns a unique TN (trainee number) and one licensed plumber to act as his or her supervisor.
- Each customer has a unique CID. Some customers are commercial and have a unique CCID. The rest are residential and have a unique RCID. Some plumbers are also customers.
- A plumbing project with a commercial customer can involve up to three licensed plumbers. Joe records which commercial customer requests the project and notes if this is the first, second, or nth project with this customer. For each assigned plumber, Joe notes the date and start time when the plumber starts work on the project. Joe also records a list of materials that are used for each commercial project.
- Residential projects are assigned to either one licensed or one unlicensed plumber. We note which plumber is assigned, the date, and the amount billed for the project. Joe also notes if this is the first, second, or nth project with this residential customer.

Design an EER Diagram with *exactly 7 Regular Entity Types (including subclasses)*, *2 Weak Entity Types*, and *5 Relationship Types (including weak entity relationships)*. Clearly label primary and partial keys, and (max,min) and subclass constraints. List any additional assumptions you need. Please present your EER on the next page.

3. (40) Five Queries in Algebra and SQL.

Consider the following database schema (Primary keys are listed first; foreign keys in ORDER are CID, AID, PID):

- CUSTOMER (CID, cname, city, discount)
- PRODUCT (PID, pname, city)
- AGENT (AID, aname, city, commission)
- ORDER (OID, day, month, year, CID, AID, PID, quantity, charge)

For each query below, write both (ALG) relational algebra expressions and (SQL) SQL statements. If it is impossible to formulate a query in one of the languages explain why. Clearly list any assumptions you make.

- (a) List the OID of orders made in October 2008 that included charges over \$1000.00
(ALG)

(SQL)

- (b) List the AID of agents that come from a city where at least one product is made.
(ALG)

(SQL)

- CUSTOMER (CID, cname, city, discount)
- PRODUCT (PID, pname, city)
- AGENT (AID, aname, city, commission)
- ORDER (OID, date, CID, AID, PID, quantity, charge)

(c) For each product from Toledo, how many have units in total been sold this year?
(ALG)

(SQL)

(d) Give (CID,PID,AID) triples such that at most 2 of the entities come from the same city.

(ALG)

(SQL)

- CUSTOMER (CID, cname, city, discount)
- PRODUCT (PID, pname, city)
- AGENT (AID, aname, city, commission)
- ORDER (OID, date, CID, AID, PID, quantity, charge)

(e) Give the AID of agents that have sold at least one of all the different types of products that are made in their own city.

(ALG)

(SQL)

4. (10) Database Design Project.

Describe one Query from your team project in terms of how it will help your client.