

**Final Quiz**  
**IEOR 115: Analysis and Design of Databases**

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**Fall 2007**

Please put your name and Student ID number on this page. You have 50 minutes to work on the exam. Check that your copy includes all pages. Please read all questions first and budget your time accordingly. 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)

Q1 (25 points):

Q2 (25 points):

Q3 (25 points):

Q4 (25 points):

Q5 (Design Project Team Evaluation):

Total:

### 1. EER Design (25%)

You are asked to design a database to keep track of traffic at an Airport. Here is the information that needs to be represented:

- (a) The airport has a number of gates, each with unique GID and list of safety features.
- (b) For each airline company that uses the airport, there is a company name and unique CID. Each gate is assigned to 3 or more companies. A company can operate up to 30 aircraft.
- (c) Each aircraft is operated by a single company and has a tailnumber unique to that company. For passenger jets we record the number of seats, and for cargo jets we record the maximum weight capacity. Some aircraft are neither passenger nor cargo jets.
- (d) Whenever a passenger jet docks at a gate, we record the date and time of arrival and departure.

Design an EER Diagram with *exactly 4 Regular Entity Types, 1 Weak Entity Type, and 3 Relationship Types*. Clearly label what you can, including primary and partial keys, Subclass/Superclass constraints, and (max,min) constraints. List any additional assumptions you need.

2. Queries (25%)

3. Consider the following database schema (Primary and foreign keys are capitalized):

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

As requested below, create an (ALG) relational algebra expression or (SQL) SQL statements that retrieves the needed information. List any necessary assumptions you make.

(a) List the total charges obtained by each agent who obtained total charges over 10,000.

(SQL)

(b) List agents who have never obtained an order from a customer who lives in another city.

(ALG)

4. Functional Dependencies (25%)

(a) Given  $X \rightarrow Y, X \rightarrow W, Y \rightarrow Z$ , Does  $X \rightarrow ZW$ ? Prove or disprove.

(b) Given  $XY \rightarrow Z, W \rightarrow Z$ , Does  $XY \rightarrow W$ ? Prove or disprove.

(c) Given  $F = \{A \rightarrow AC, B \rightarrow ABC\}$ , What is  $F_{\min}$ ?

5. Normal Forms (25%)

Given  $R(A, B, C, D, E, F)$ , with  $\{AB \rightarrow C, D \rightarrow B, B \rightarrow E, F \rightarrow D\}$ .

(a) What is a Candidate Key for R? Show all work.

(b) Consider  $R_1(A, F, D, B, E)$  and  $R_2(A, B, C)$ . Normalize into 2NF.

(c) Normalize into 3NF.

6. Design Project Team Evaluation (for DP grading):

List your Team Number and Client name. Then list each member of your team including yourself from the list on next page and rate their contributions to the team as follows. You have 100 points to distribute among your other team members. For example, if your team had 6 members and all contributed equally, you might give everyone 16 points. If you feel you personally did all the work, you can give yourself 100 points and everyone else zero points...and so on. Please feel free also to make comments on performance. Please note that these ratings and comments will be kept confidential.